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GUIDE TO - - - - SMALL-SCALE INDUSTRIES

by

M. C. MOHAN, B.A.

Incharge, Sir Ganga Ram Business Bureau & Library, Editor-in-Chief, 'The Careers', Lahore, Director, 'Forward Bureau', Assistant Secretary, Hindu Students Career Society, General Assistant, Sir Ganga Ram Trust, Editor, 'The Widows' Cause', Etc.

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Some Important Hints.

The books and journals referred to in the pages of this book should first be consulted and selected, before purchase, at any of the following libraries, which specialise in technical books:—

Imperial Library, Calcutta; Commercial Library of the Department of Intelligence and Statistics, Calcutta; Central Library, Baroda; Sir Ganga Ram Library, Lahore; Libraries attached to the Departments of Industries at Lahore, Cawnpore, Calcutta, Madras, Bombay, Patna and Mysore, Library of Harcourt Butler Technological Institute at Cawnpore and Libraries attached to Industrial and Technical Institutes of the Country.

These books may also be available in various government, public or private libraries.

Full particulars and descriptions about various industrial institutions have been avoided and it is recommended that this book be read in conjunction with author's *"Guide to Indian Industrial Studies"* that contains prospectuses of various industrial, institutes referred to in this book.

The adresses of various machinery dealers and other firms are given without any prejudice or responsibility about their financial positions. These firms may be consulted for machinery.

After a thorough study of this book, an expert on the line selected should be personally consulted before actually going in for it.

CONTENTS.

Preface to Third Edition.

The warm reception accorded to the first two editions of this book indicates, clearly, the trend of the day. The consciousness of the educated community has been awakened and there has been created a tremendous demand for information leading to industrial careers. Some progress has been made, during the past few years, in the industrial rejuvenation of the country, as many laudable industrial enterprises have been set up successfully. But in a country like India, which is blooming in the youth of industrial resourcefulness, and which feeds the world with its demand for manufactured articles, the progress made, so far, is very slow. There are hundreds of manufacturing industries, which can be taken up successfully by our countrymen and which stand untouched or half touched. And therefore, the opportunities in industrial avenues are unlimited.

Whereas the first edition was a medley of industries, professions, trades and arts, the present edition is devoted purely to industries and every industry has been dealt with more exhaustively in these pages. Special attention has been devoted to their economic aspects.

My thanks are due to the Director of Industries, Punjab, the Director of Industries, Bombay, the Editor of the Industry and others for information and literature supplied by them about various industries referred to in pages of this book.

Mohan Cottage,
Moheni Road, Lahore.

M. C. MOHAN.

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Lahore.

Preface to First Edition.

India is one of the richest countries of the world so far as her natural resources are concerned. She is one of the strongest countries of the world on account of her sturdy and hardy population of teeming millions. But, inspite of all that, she ranks amongst the world's poorest nations for her political subjection and lack of industries. She looks upto foreign hands not only for her protection but for her very subsistence too. She prostrates before other nations to shelter her, to feed her, to meet her daily necessities and to drag her dreary existence. Millions of her population live and die as paupers, naked, starved, weak, illiterate and degenerated. Millions of them die annually for want of adequate food or treatment of their ailments and majority of her people never have a pride during their lifetime to posses a golden ringlet, a silk handkerchief, a watch, a chair, a suit case, a glass tumbler or even a towel.

It could not be otherwise. Industry is the essential handmaid of modern civilisation ; it is a power in politics and above all it is the only source of affording employment, living and prosperity to crores of people. Consequently a country, that goes without it, is doomed to slavery,

exploitation and ultimate ruit. India is fast advancing towards that end and the only panacea for her regeneration lies in the revival of her industries that would make her people not only prosperous and happy but would solve the acutest problem of the day—securing employment and living for the educated middle classes who are on the very verge of their wreck. The University education imparted to them have incapaciated them to earn their living by means other than that of driving pen. In fact, they where educated to serve that one object and they have not belied their education. But the doors of government services have been practically shut to them and this has left them in a dilemma and the only option for living before them lies in their taking up to industrial enterprises and business careers.

In most countries the members of middle classes are found to take a predominant part in and often lead trades and professions. In India, however, the educated middle class men have been drawn more towards intellectual professions than intellectual business careers. The result is that professions have been crowded and trade, commerce and industy have been denied the lead of the intelligentsia which they need for proper development and opening out of such avenues of industrial employments as exist in other civilised countries.

Prospects of industrial careers have not been adequately recognised by the people of India. Reward of industrial and business efficiency is sometimes beyond the greed of avarice. Income of even the cleverest professional men pale into insignificance before the drawings of industrial magnates. A successful industrialist is much better off than a successful man of the so-called learned

professton or a service man. What is true of the rank is true also of the file. An average industrial worker is usually better paid than an average clerk or a school master. The humble shoe-maker often earns more than a university graduate. The former happens to be always employed while the latter is often in futile search of employment.

It is high time that the middle class youths and their guardians in India recognise the possibilities of industrial careers. If sufficient number of the educated Indian young men choose the industries as their vocation, two pressing problems would be solved. First, the industries would be developed and secondly middle class unemployment would be reduced to an adequate extent.

During my experience in the line of vocational guidance during the ten six years, I have noticed it with pain that the very mentality of our educated youths has become so slavish that they can neither realise nor appreciate the beauties of an industrial career. They appear to have been born as slaves as they would dream and accept nothing but service, with all its insults, in comparison with a free business career. The main cause responsible for it is their education, which has, above all, deprived them of self-confidence, grit, tenacity of purpose and infinite patience—the very characteristics required for an industrial career. These in fact form the very qualities which make a man. And if some happened to take up to business enterprises they had either to abandon those at a latter stage or to undergo great loss in making it a success. This was because their choice was based on scant, unreliable and hearsay information which often does more harm than any good.

It was, therefore, that I undertook to bring out the work in hand, firstly to present before the educated youths of this country a vast field of avenues open to them in industry wherein the energies spent would undoubtedly yield bigger laurels than those possible in civil service. It deals with arts, crafts, industries and trades as require small capital as I realise that Indians have a little left after they have educated their sons upto the Matriculation or Degree Examinations and I believe that merchant-princes or captains of industry are, as a rule, self-made and self-taught. The second aim in bringing out this work is to enable the various individuals, already in some service or work, to supplement their income by following some trade or profession during their spare hours. India has large number of middle class families who are living from hand to mouth. Schoolmasters and clerks belong to that category particularly. They have ample time which they while away in unprofitable and harmful occupations or idle talk. Much of their distress would be relieved if they only occupied those hours in pursuance of profitable occupations referred to in pages of this book.

If this book enables a youth to analyze and compare his aptitudes, capacities and interests with the requirements of representative trades and industries and plan his career accordingly or if it proves a source of adding to the income of any family I would feel myself amply rewarded and my labour well directed and appreciated.

Mohan Cottage,
Moheni Road, Lahore.

M. C. MOHAN.

Absorbent Cotton

Absorbent Cotton is a very important article for hospital use and hygienic purposes. India imports a very large quantity of it every year, as it is being used in large quantities and with the progress of civilisation in the country, its demand would be still greater. At present it is being manufactured in the country at Calcutta only where three factories are manufacturing this article and working profitably.

As India is, undoubtedly, one of the biggest cotton producing countries of the world and as its supply of cotton is far in excess to its demand for cotton as is evident from the export figures (Rs. 23,78,19,000/- cotton, exports in year 1931-32) there is no reason, why India, with such a cheap chief stuff, should not manufacture the product at profit. Moreover India has a mushroom of spinning mills where waste can be profitably utilised in manufacturing inferior kind of absorbent cotton.

As throughout the vast country of India there are but three factories manufacturing this article and as there is also vast field for the marketing of this product in Afganistan, Persia, Mesopotamia and other neighbouring countries, there are chances for really enterprizing business men.

The manufacture of hospital dressings such as bandages etc. can easily be started as a subsidiary industry with a further capital of about Rs. 10,000/-.

The following information compiled by the Industrial Chemist to the Punjab Government would be of interest:—

Process of Manufacture

Cotton is boiled with a 5% solution of caustic soda or potash for half an hour. It is then thoroughly washed and

all water is pressed out as far as possible and then immersed in a 5% solution of chloride of lime (bleaching powder) for 15 to 20 minutes; washed with a little water, then with water acidulated with hydrochloric acid and then again with clean water. Now it is dried in hot air chambers, broken in openers and after passing through wadding cards rolled, cut and dried ready to be packed for the market.

Machinery required

A list of machinery required for a factory capable for producing about 500 lbs. in 10 hours is given below :—

		£.	$.
1.	1 Crighton Opener	181	0
2.	1 Beater Scutcher	212	15
3.	1 Washing and Rinsing Machine	115	5
4.	1 High Pressure Kier	176	0
5.	1 Chemicing, Scouring and Washing Apparatus	133	0
6.	1 Chlorine Dissolver	50	0
7.	1 Haubold Hydro-Extractor	78	0
8.	1 Wet Picking Machine	104	15
9.	1 Rack Drying Machine	219	0
10.	4 Wadding Cards @ £ 237-10 each	950	0
11.	4 Sets of card clothings @ £ 57-5 each	229	0
12.	2 Cotton Balances @ £ 7-15 each	15	10
13.	1 Grinding Machine	47	5
14.	1 Set of Auxiliary Tools	30	10
15.	1 Wadding Press	94	15
16.	1 Wadding Winding Machine	61	10
17.	1 Wadding Roll Cutting Machine	32	15
18.	1 Portable Iron Roller Machine	8	0
19.	1 High Pressure Steam Sterilisator	232	0
	Total ...	£ 2971	10

To this is to be added the cost of generating power, erection and other connection which would come to another ten thousand rupees.

Building

A layout of the plant and floor space required is given in the blue print attached. It would cost approximately Rs. 30,000/- at the rate of Rs. 3/- per sq. ft. The dimensions of the building would be 180′ long by 60′ wide with saw tooth roof.

Labour

For working out the above factory the following hands are necessary:—

1 Expert at Rs. 450 p. m.	Rs. 5,400	per annum
1 Foreman at Rs. 150 p. m.	Rs. 1,800	„ „
28 Factory hands at Rs. 20 p.m. each	Rs. 6,720	„ „
Clerical Establishment=4	Rs. 2,400	„ „
Total ...	Rs. 16,320	„ „

Total investment required to work out such a plant is Rs. 75,000.

Expert

The necessary qualifications required for an expert would be the knowledge of chemical engineering with special training in the processes of bleaching, drying and carding. I think such an expert may be available from Calcutta or one of our own chemists may be sent out for necessary training in one of the three factories working in Calcutta wherefrom a clever man would be able to pick up the working of such a factory in about six months time.

Foreman

A qualified mechanical engineer with a knowledge of the fundamentals of Chemistry would be quite efficient to

discharge these duties. Such a man would be available locally.

Labour

Trained labour accustomed to handle various machines to be found in a well equipped mechanical workshop would do.

Economics of the Industry

A hypothetical balance sheet of the factory during the first year of its working is given below :—

	DEBITS.		CREDITS.
1.	Cost of raw material: 2160 maunds at Rs. 20/- a maund	Rs. 43,200	Sale price of 1,80,000 lbs. of cotton to an average price of annas -/10/- net per lb. after all deductions, commission etc.
2.	Wages etc.	„ 16,320	
3.	Cost of motive power	„ 18,000	
4.	Rent, rates and taxes	„ 1,000	
5.	Repairs to plant and machinery	„ 600	
6.	Depreciation to plant at 10% on 50,000	„ 5,000	
7.	Depreciation to building at 2% on 30,000	„ 600	
8.	Other charges	„ 6,000	
	To profits during the first year	„ 21,780	
	Total ...	Rs 1,12,500	Rs 1,12,500

Mills Manufacturing Absorbent Cotton

Bengal Chemical and Pharmaceutical Works Ltd., 15, College Sq., Calcutta.

Keshoram Cotton Mills, Garden Reach, Calcutta.

Lister Antiseptics and Dressings Co., 14, Hare St., Calcutta.

Dealers in Machinery for Manufacturing Absorbent Cotton

William Tatham Ltd., Rochdale, England.

Greaves Cotton & Co., Ltd., Bombay.

Journals and Books.

So far as the author's knowledge is concerned, there is no journal or book devoted solely to this industry. The subject is treated from time to time in various journals dealing with textiles, manufacturing lines and medical dressing, etc.

Bakery and Biscuit Making.

Bakery and Biscuit Making is becoming an integral trade and as a source of the health of community deserves greater attention than has been given to it hithertofore by the Indians. In western countries the industry is occupying a first class position amongst industries and thousands of persons are engaged in to. Since the introduction of machinery for kneading flour and mixing ingredients and electric ovens, this industry has advanced in great strides and is specially fitted for the educated youths.

The demand for high class bakery products are increasing with the higher classes of the population and the industry is becoming popular. During year 1931-32, India imported 36,000 cwts. of biscuits and cakes valueing at Rs 29,90,000. All the chief ingredients being available in the country, there is no reason why this amount should be allowed to be drained out of the country. The chances of the development of the industry are greater taking in view the fact that the orthodox section of Hindus do not take eatables manufactured by non-Hindus.

Flour , starch, arrowroot, cornmeal, rye flour, oatmeal, maize flour, ground rice, potatoe flour, sugar, honey, fat, liquid, powders, egg, skim milk, gelatine, cocoa powder, albumen, brandy, chemicals (alum, ammonia, bicarbonate of soda, cream of tartar, salt, tartanic acid), flavours, fruits (almond, apple, pulp, raisin, currant, orange walnut etc.), fats, (butter, margarine, cocoanut butter, palm oils, lard) for greasing the pans are the chief raw materials in use for manufacturing cakes and biscuits.

And all of these articles are available in the country, majority of which at very cheap rates.

Hotels, restaurants, tea stalls, provision stores, hostels, military supply departments, milk shops, confectioners, co-operative associations and residences of upper classes, are important outlets for the bakery produce. These have regular demand and more can be created by sending around agents on cycles, carts or tongas, door to door, for creating demand and making distribution every day. Now-a-days every first rate bakery has a regular distributing arrangement. For biscuits a great advertisement campaign is to be carried out.

Bakery

Bakery with a kneading machine and an electric oven can be started with a capital of about Rs. 8,000 in a city, as a village or town cannot consume the output of such a bakery. Bakery with machinery can be started with a few hundreds only as the main instruments required there are:— the oven (which consists of a brick oven, fitted with an iron door with the heat placed underneath), moulds, steel plates, pans etc., the main capital being invested in raw materials, purchased in large quantity, to face competitive prices.

Machines for bakers & confectioners.

Amongst those special machines which foreign manufacturers have brought to a high state of development those used in bakeries and confectioneries occupy a very important position as they are specially in great demand on the Indian market. The advantage of mechanical dough-making over the old methods is not only that the rate of production is increased, but also that the standard of hygiene is raised. For those reasons the manual work in the bakeries is being gradually supplanted by the use of machines. It is, above all, the dough-kneading machine to which, in the mechanisation of the bakery, the greatest

attention has been paid. When one considers how unhygienic and unappetising is dough if kneaded by hand and even, in the case of particularly heavy kinds of dough, with the feet, it is easily seen why efforts were made from time to time to produce machinery to undertake this work.

The reason that the dough-kneading machine took such a long time to attain anything like popularity was principally that the early designs possessed so many obvious disadvatages. The kneading-arm, for instance, moved about in the trough like a shovel, and it was unavoidable that the lubricating oil at the joints found its way to the dough, making it dirty. This and other disadvantages made the employment of kneading in bakeries unadvisable. It was only about the close of the nineteenth century that dough-making machines of improved types made their appearance. These were improved to such an extent that all the drawbacks which had hitherto existed were eliminated. Further improvements in the design of the kneading-arm and of the trough, the latter of which was a rotary and travelling type led to greatly increased outputs. In the machines of this type the vessel revolves during the kneading process, with the result that the kneading-arm, which enters the vessel from top and kneads the dough as by hand, bit by bit, deals with the entire contents of the trough. When this process is completed the vessel is removed to the scene of the next process.

Before the dough is kneaded the flour which is to be made up into dough must first be freed from any foreign bodies which may be present, such as grit, threads, and so on. This is of course, done, by passing the flour through a sieve. When this is finished the flour is converted into dough in the usual manner. It is at this point that the activity of the dough-kneader commences.

A large part of the dough must be divided up into small pieces of equal weight for the making of rolls, beans, cakes, and so on. For this purpose many bakeries make use of the doughdivider, which divides off the desired portions with a single movement of a lever and thereby completely eliminates the chance of any contact between the dough and the hands of the operator. This machine is very simple in design, and deserves a place in even the smallest bakeries. There are in addition other machines, such as the raiser, the crescent-roll machine, and so on, some of which are combined with others to form compound machines. Thus we find multiple machines which comprise a moulding press and a dough-divider for rolls. The chief advantage of these machines is that when the dough has been pressed and divided it is not necessary to take it out of the machine; a single motion of a lever suffices to cut out into desired shape a large number of pieces of the dough in a few seconds. The machine is admirable for making rolls, rusks, biscuits etc. We should also like to mention here the automatic dividing and moulding machine for weighing out and shaping long pieces of dough in a few seconds. The machine which is indispensable to any modern bakery which desires to run rationally and economically.

When the layman thinks of confectioners' machines, the first thing which comes into his mind is probably the ice-cream machine. Marvellous progress has recently been made in the design of these machines, which have been brought to a very high pitch of perfection indeed. Whether the machine is to be driven by hand or by power is a matter of indifference; the fundamental principle is the same. And in every case care must be taken that the materials of which the ice-cream is composed be thoroughly mixed and churned up, so as to ensure that the resulting product is of a fine and uniform consistency. Another point

to be considered is that the material of which the machine is made must be acid-proof, so that, even when it is kept in the container for some time, neither the appearance nor the flavour of the ice is effected.

Other machines which are worthy of attention are the almond crushing machines, which are used especially for the preparation of such paste-like masses as chocolate. Two or three granite rolls, or, for special purposes, steel rolls, with various speeds crush the almonds as they pass between them. Almonds, ground-nuts, or hazel-nuts can be cut up small in almond-cutters, and peeled in almond-peeling machines; in the latter case the nuts are plunged into boiling water, the water is allowed to run off, and nuts are then passed through a pair of rolls made of Para rubber.

The cutting-machines form a special group of their own. Examples which might be cited are the biscuit-cutting machines, which "stamp" and cut out the biscuit dough, the rusk-cutters which cut into slices round and oval rusks and the cube-cutting machines, which produce cubes.

This by no means exhausts the list of machines used by the confectioners; there are still many machines of minor importance required by them in the process of manufacture of which the most interesting is the almond-slicing machine.

And finally we should like to close this chief account by drawing attention of the new-comer in these lines that the machines of improved types are now-a-days manufactured by the German's firm "Habamfa" Hallesche Backerei-maschinen-Fabrik Rausch & Filbry, Ammendorf near Halle A. S. (Germany).

Thus, we see that the mechanization of the world of to-day has made no exception of the bakery; and the day is

probably not far distant when hand-prepared loaves and pastries will be things of the past.

Biscuit Making.

The biscuits may be characterised by palatability, crispness, and nutritious properties and the best varieties of biscuits remain perfectly sound for a long time.

Biscuit-baking constitutes two separate branches of manufacture—namely, that of the ordinary biscuit, or so to speak, biscuit proper and that of fancy biscuits. Ordinary biscuit consists of only flour and water kneaded into a paste, cut in the proper shape, docked, and baked in an oven; fancy biscuits consist also of flour and water, but with an addition of butter, sugar, eggs, spices, or "flavouring," all or either of them according to the kind. Ordinary biscuits are now made by machinery, and one of the reasons for this has been that the manual preparation was too slow and too costly.

For this reason we shall dispense with the method of making biscuits by manual labour and treat the subject with modern machineries.

In the manufacture of biscuits the first operation is to prepare the dough which can be produced either by hand or by machine, but now-a-days machines are employed with great efficiency. The flour is conveyed into a hollow cylinder four or five feet long and about three feet in diameter and the water, the quantity of which is regulated by a gauge admitted to it; a shaft, armed with long knives, works rapidly round inside the cylinder, with such astonishing effect, that in the short space of about six minutes, 450 lbs. of dough are produced, infinitely better made than that mixed by hand. The dough is removed from the cylinder and placed under the breaking rollers ; these latter, which perform the office of kneading, are two in number; they are rolled to and fro over the surface of the dough by means of machinery, and in five

minutes the dough is perfectly kneaded. The sheet of dough which is about two inches thick, is then cut into pieces half a yard square, which pass under a second set of rollers so that each piece is extended to the size of six feet by three, and so reduces it to the proper thickness for biscuits. The sheets of dough is now cut up into biscuits ; and no part of the operation is more beautiful than the mode by which this is accomplished. The dough is brought under a stamping or cutting-out press, similar in effect, but not in detail, to that by which circular pieces for coins are cut out of a sheet of metal. A series of sharp knives are so arranged that by one movement they cut out a piece of dough to several pieces of hexagonal biscuits. The reason for an hexagonal shape is that not a particle of waste is thereby occasioned.

Each biscuit is stamped by the same movement which cuts it out of the piece of dough. The cutters do not sever the biscuits completely asunder, so that a whole sheet of them can be put into the oven at once on a large peel, or shovel, adapted for the purpose. About 15 minutes are sufficient to to bake them ; they are then withdrawn and broken asunder by hand.

The manufacture of fancy biscuits, which in former time was confined to pastry cook and confectioner, has of late years assumed considerable importance, and several firms are now exclusively engaged in this branch of industry, the products of which are sold under an extraordinary variety of names. Some of these, namely, the plain biscuit, arrowroot, brown meal, caraway, nice, cream craker, etc. are intelligible enough ; but macarooms, cracknets, with the names of which the public are familiar from long usage, the rest of the products form a list of upwards of eighty fanciful names, all expressive of articles of different form, appearance, and taste made of nearly the same materials with but little variation in the

proportion in which they are used,—the principal ingredients all being flour and water, butter, milk, eggs, and caraway, nutmeg, cinnamon, mace, ginger, essence of lemon, neroli, or orange-flower water, called in technical language "flavouring". The kneading of these materials is always performed by a kneading or mixing machine. The dough produced is passed several times between two revolving cylinders adjusted at a proper distance so as to obtain a flat, perfectly homogeneous mass, slab or sheet. This is transferred to a stamping or cutting machine, consisting of two cylinders, through which the sheet of homogeneous paste has to pass and by which it is laminated to the proper thickness, and at the same time pushed under a stamping and docking frame, which cuts it into discs or into oval or otherwise shaped pieces, as occasion may require. The stamps or cutters in the frame being internally provided with prongs, push the cut pieces of dough or raw cakes, out of the cutting frame, and at the same time dock the cakes or cut pieces with a series of holes, for the subsequent escape of moisture, which, but for these vents, would distort and spoil the biscuit when put in the oven. The temperature of oven should be so regulated as to be perfectly uniform, neither too high nor too low, but just at such a heat as is sufficient to give the biscuits a light brown colour. For such a purpose the bakery oven by Mr. Perkins, is the best that can possibly be used. This oven offers the peculiar advantage that by turning the screw, the sole of the oven can be brought nearer to the top, and a temperature is thus obtained suitable for baking thoroughly, without burning, the thinnest cake.

Within the last few years there has been a very remarkable development of the trade in biscuits. Biscuits of all sorts, and really many curious and agreeable varieties are now manufactured on a large scale, and machinery has been created to facilitate the process. (Industry).

Economics of the Trade.

M/s. L. T. Pinto & Sons, Lahore, Write:—

The question of the working expenses of a Biscuit Factory is a very difficult one and to deal with or to give any figures on, as so much depends on the management, the number of employees working, the cost of ingredients, fuels, oils, etc. We may, however, say without any hestitation that biscuit factory equipped with modern machinery and conducted under the efficient management should prove to be very profitable business to the owners. This is evident from the large number of biscuit factories which have been opened in India and in the East during the recent years; all the factories have undoubtedly been showing very handsome profit, with output continuously increasing.

Approximate Working Estimate of a 20 cwts. Fancy Biscuit Plant per day.

14 Cwts. Flour	...Rs,	60—0—0
5 „ Sugar	... „	50—0—0
3 „ Butter	... „	250—0—0
Chemical & Ingredients	... „	25—0—0
Eggs	.. „	25—0—0
Wages of factory workmen	... „	30—0—0
Coal for oven firing	... „	15—0—0
33% to cover cost of packing tins advertising, establishment and trading charges	... „	150—0—0
Interest @ 6% per annum on capital outlay of Rs. 75,000	... „	15—0—0
10% depreciation on above per day	... „	20—0—0
Approximate cost of one ton Biscuit	... Rs	640—0—0

Sale proceeds of 20 cwts. biscuits at the lowest rate of Re. 1. per lb. Rs 2240—0—0

Estimate for biscuit plant capable of producing approximately 15/20 cwts. per day of eight hours.

One "Baker Thomson" vertical hard and soft dough mixing machine. Power required 10 H. P. £ 453

Extra steel tub and carriage. ...£ 48

One "Baker-Thomson" power reversing hard and soft dough brake, 3 H. P. £ 243

Haining-Macfarlane safety gear £ 47

One "Baker-Thomson', biscuit cutting and panning machine. Power required 6 H. P. £ 665

Overhead variable speed gear if required 'excluding pulleys or striking gear £ 86

One Set of 34 "Gem" Biscuit Cutters £ 61

" " " 8 "School', " " " 50

" " " 8 "Thin Arrowroot" " " " 84

" " " 7 "Marie" " " " 60

" " " 7 "Nice" " " " 60

120 Best quality charcoal iron biscuit baking pans 26″×20″, with welded corners " 82

150 Best quality biscuit baking wires 26″×20″, " 55

One No. 4. A. (4 E. C.) patent disc sugar grinding Mill. " 95

One No. 7 size patent gearless whisking machine " 23

Electric Motors, suitable for Direct Current of 230 Volts for driving the machines offered under first fifteen items. " 82

All the necessrry Shafting, Pulleys, Hangers and belting for the foregoing machinery " 88

One Biscuit oil-heated travelling chain oven 40 ft. " 2410

or One Baker keith latest design gas heated travelling biscuit oven. " 1922

or One Set of Metalwork for the building of a Brick Built, Coke, Coal or wood, heated travelling chain biscuit oven, 40 ft. „ 1155

Tiles; Necessary tiles for covering the flues and special fireclay blocks. „ 195

Electric motor:— Suitable for brick built or oil fired oven ... £ 35.

Note : No firebricks, common bricks, sand, lime cement, etc, and other things which are not specified in this tender are included and the same can be purchased locally.

Prices : The prices quoted in this estimate provide for packing and delivery C. I. F. Karachi and they do not include any custom Duty which is on purchaser account.

Terms of payment : One-half value in advance with order and balance against presentation of shipping documents through any bank of Karachi.

Delivery : The plant offered would be ready for shipment in three months time from the date of receipt of order by the manufacturers in London. The shipment from London to Karachi would take about six weeks. The clearing and forwarding job at Karachi is a matter of only a week. The transit etween Karachi and Lahore would take about ten days.

The manufactures would be prepared to send to India their own man who is a skilled biscuit maker. He is thoroughly competent to supervise erection and to teach your staff. For the services of the expert one has to pay his fares both ways, the exact salary which the manufacturers pay him for the time that he is away from foreign country and his living expenses whilst on the job. According to our calculations, the approximate expenses would be round about £ 400 (Four Hnndered Pounds only), for a period of three months. As an alternative the manufacturers would be prepared to engage on your behalf and in

consultation with you a suitable biscuit maker for a period of one year or longer.

If the factory is ready the actual erection of machinery and oven will not take more than 2 minutes.

Training.

There is no institute in the country imparting a training in bakery or biscuit making. But arrangements can be made to learn the art as an apprentice in some biscuit factory or bakery.

A knowledge of general science and particularly of the science of chemistry is essential for one to get an insight into the processes which would otherwise be mere rule-of-thumb operations, as unexpected difficulties crop up in the way of manufacturing and we must have knowledge to surpass over the difficulty.

The following institutes in England impart training in bakery:—

Borough Polytechnic Institute, Borough Road, London S. E. 1.

Stirling Continuation Classes, Stirling.

Technical College, Leith.

Technical College, Cardiff.

Biscuit Manufacturing Firms

Arya Bakery & Confectionery, 10-1, Chakraberty Road, Calcutta.

Automatic Bakery, Nisbet Road, Lahore.

Britannia Biscuit Co., Calcutta & Bombay.

Delhi Biscuit Co., Delhi.

Ganga Bakery, Lahore Cantt.

Huns Dewan & Co., Bombay No. 8.

K. C. Bose & Co., 2, Kalachand Sanyal Lane, Calcutta.

Lily Biscuit Co., Calcutta.

Renown Biscuit Co., Bombay.

Machinery Dealers and Suppliers.

A. Gillespie & Sons Ltd., Glasgow.

American Baker's Machinery Co., 1600, S. Kingshighway, St. Louis, M. O. (U. S. A).

Baker Perkins Ltd., Peterborough, England.

Berliner Backerei-Maschinenfabrik Freidrich Schroter, 017, Langestr 79, Berlin, Germany.

Bombay Berlin Handelsgesellschaft Dalal & Co., McLeod Road, Karachi.

Cox & Co., Birmingham.

D. Thomson Ltd., Edinburgh.

Industrial Machinery Co., Clive Street, Calcutta.

L. T. Pinto & Sons, The Mall, Lahore.

Lehmann J. M. Co., Inc. 248, W. Broadway, N. Y. City, (U. S. A.).

Peerless Bread Machine Co, Sidney, O. (U. S. A).

Books

Bennion J. E.—Bakery Science 5 Sh.

Ellis D.—A Science Course of Bakers 5 Sh.

Fritsch J.—The Manufacture of Biscuits, Cakes and Wafers 25 Sh. (Pitman).

Grant J.—The Chemistry of Bread Making 6 Sh.

Home Industries (Industry, Calcutta).

Malzbender's—Practical Receipt Book for Bakers and Pastry Cooks.

Stewart J.—Bread and Bread Making 3 Sh.

Journals

Baker and Confectioner, London S. E. 1.

Bakers Record, London E. C. 4.

Bakers Review, New York (U. S. A.)

British Bakers, London E. C. 4.

Master Baker, Belfast.

Brush Making.

With the rise in the standard of living and that of civilisation the use of various kinds of brushes has enormously increased in this country. Whereas it is a necessity in some cases it is a luxury in others. They are used generally for cleaning, scrubbing and brushing of articles like clothings, caps, bottles, etc., for painting, varnishing, shaving, cleaning of teeth, pasting of medicines, rubbing animals, floor cleaning and machineries etc. They are in universal demand, which is every day on increase.

The following are some of the important features that favour the establishment of brush factories in India.

(*a*) There exists a great demand for this commodity. Over £ 75,000 worth of brushes are imported in the country every year and the demand is on increase, every day, with the increase in civilisation.

(*b*) All the raw materials for the brushes can be had in India ; such as various fibres, bristles, wood, ivory, etc.

(*c*) The industry can employ females and children and can be carried on any scale and with any capital.

Materials for Brush Manufacture.

A large variety of substances have been utilised for brush making for various purposes, and of all these bristles and animal hair form the chief materials. Bristles (especially of white hog's) are available in large quantities and are exported to foreign countries. In year 1931-32, 3,000 cwts. of bristles have been exported. These valued at Rs 11,16,000 Thickest bristles are best suited. Hog's bristles are used for brushes for hair, tooth cloth, and hat cleaning. Hog's bristles are used where excellence of quality is desired.

Bristles plucked from living animals are rated superior to those obtained from carcasses. The black, grey, yellow, white and blue colours are in use. Bristles vary from 3 to 10 inches in length, the modestly long hair being better than very long. The thickest and white bristles are best. Wire is used for brushes for scrubbing metallic surfaces while span glass is used for acid washing. Feathers are used for pencils brushes for painting purposes. Hair of camel, goat, squaril and horse are also used. Amongst vegetable raw materials, the fibres of the palmyra, the coconut, the aloe, exparte, glass and munj, are important. For back grounds and handles, wood, ivory, tortoise shell, bamboo and metals are mostly used.

Indian sources of brush materials are:—

Taung-ong, eju, gumuti (the coarsest varieties of these three), the roots of shipur gaddi, vina pullalu and thodapga pullu, for making weavers' brushes in Madras; Bombay aloe fibre, found in Bombay, Madras, C. I. and Gangetic plains and somewhere in the Punjab; bamboo, roots of chrysopogon gryllus, the shorter and stiffer fibres of coconut, leafy stalks of seedling palmyras found in Kistna, Godavari, Tinnevelly District etc; mari, bherawa, conda-panna and minbaw found throughout the hotter parts of India from Sikkim, Himalaya and Assam to Ceylon and Singapore and this fibre is mostly in request in European countries; khas khas which is found throughout the plains and lower hills of India, Burma and Ceylon ; juar, chari, Kangra and Talla ; the roots of the screw-pine ; munj ; wild date and date sugar palm ; baboi, bhadar, sabai, moya, bankas and som-grass found througout the drier tracts of India from Chota Nagpur and Rajmahal, to Nepal and Garwal, Punjab, and C. P. and C. I.

Classification of Brushes:—

Brushes and broms are of two kinds, simple and compound brushes. Simple brushes are made by inserting a tuft of hair along with their roots bound together into a quil, which is softened before hand and which in drying serves to hold them fast. This is for smaller brushes. In longer brushes, a tin tube, round or flat is utilised. Paint brushes fall under this catagory.

For compound brushes, wooden stock is bored, generally in a lathe with hole which vary in depth, size, direction to suit a set purpose. Compound work is subdivided into two classes; set work and drawn work. The trepanning brushes are the best kind of brushes and in making these " a number of holes are drilled in the bone back, longitudenally or transversely and a number of holes are sunk through to these from the face side of the brush ; the tufts are then drawn with strong thread or silk and the longitudnal or transverse holes filled with plugs of brass or ivory".

Brush-Making Machines.

When enumerating the requisite articles for personal use, for the household, and for industrial purposes we find that the brush occupies a most predominant place, and is to be found in a variety of forms and styles as almost no other industrial product. This being the case, the novelties which have been constantly produced by Messrs. Zahoransky from the earliest days of their establishment have found an enthusiastic welcome in expert circles everywhere. Recall the toothbrush and compare it with the street-broom and you will then get an idea of its various forms and purposes. Until about a quarter of a century ago, brushes were made by hand, at least as regards the drawing in of the fibre and bristle bunches because the very variety of kinds mentioned seemed to raise

insurmountable difficulties in the way of mechanical production. The endeavour to supplant work by hand, led several large brush factories, some time ago, to make experiments with specially constructed machines, but these were only partly successful. It is undoubtedly to the credit of Messrs. A. Zahoransky in Todtnau (Germany) to have become the pioneers of mechanical brush-making within the last 25 years, and to have introduced their special machines into general use. This firm to-day supplies machines for mechanical production, from the very finest toothbrush, hair and clothes brushes, head and household brushes, up to the coarsest brooms and industrial brushes in most astounding perfection, and has practically conquered the world's market by their excellent construction and first-class workmanship. There is hardly any part of the world where the machines of Messrs. Zahoransky are not in use. This is not all, for even smaller concerns, where handicraft is not entirely supplanted, are supplied by the firm with improved special tools and simple machines for the aid of brush-making.

Brushes are mass production articles; and large as well as small work must look for the most rational method of production.

One may say that the productions of Messrs. Zahoransky are almost as manifold as the articles of the brush industry, and they can meet all requirements of small and large works. Let us first consider the tools and machines in use in small factories. First are the bench and bunch shears which offer considerable improvements compared with those formerly in use; an excellent aid in small works is the "Ideal" machine which divides fibre or bristles into bunches, and is to be had in different sizes for numerous purposes. Wherever there is power, the loop-filling machine does excellent service by its manifold utility and simple manipulation,

which are guaranteed by its careful construction and solid execution. The head-stocks and boring carriages and ordinary wood-boring machines for brush backs also have considerable advantages compared to other articles in the line and are found in many smaller works. Hand shears, mixing combs, hatchels etc. are to be mentioned as of lesser importance, but they are also supplied in best material and make.

To begin with the work on the wooden parts of the brush ; for this we have the "Reform" shaping device, a novel construction, which is much more advantageous for most kind of work in this line than the ordinary shaping machines, and besides enables two workmen to do different shaping work at the same time Then comes the four-spindle boring machine for the wooden backs on which, with a simple stencil pattern made in any brush factory, the holes can be bored simultaneously in every width and size desired into four wooden backs. Enormous quantities of work can be accomplished with the aid of this machine by the most unskilled workman.

The latest creation, the "Triumph," is made for the most varied wooden shapes and distribution of holes, also for hollow and round brushes, as well as for toilet and glass brushes. The holes bored by the four-spindle machine are always particularly neat and exact. This is of great advantage for the work of fixing in the bristles by hand; and an absolute necessity if it is to be done by machinery. One four-spindle boring machine is employed in conjunction with one or more loop-filling machines for fastening the bundles of bristles makes it possible for even small factories to undertake a perfectly mechanical and accordingly rational manufacturing process, This naturally tends to make the smaller works both efficient and competitive.

Let us consider more closely the loop-filling machine; it serves to fasten the bunches of fibre or bristles mechanically. This had long been the unattained ideal of every brush specialist, and much time and thought had been spent in trying to construct a proper machine' For the one finally set up, the holes in the brush backs must be previously bored by a boring-machine. This can be done by an ordiuary one, but for really profitable and rational work it is far better to employ the four-spindle boring machine When the loop-filling machine is employed, the backs with the drilled holes,—contrary to the practice with an automatic—must be held by hand to the machine which fastens the bunches by means of loops of round wire, formed independently by the machine. The primary condition in working with punching machines is a flawless operation, and we can count upon this with Zahoransky machine as with no other. This machine is made for various sizes of holes and different brushes, also for round brushes, coco brooms, etc. This machine—unless smaller works have limited themselves to the mass production of a few special articles—is really only suitable for large concerns, because such an automatic machine can only be set for a few similar kinds of brushes at a time. Whereas the loop-filling machine, (as mentioned before), calls for holes previously bored by a boring machine and must be tended by hand to fasten the bunches of fibre etc., which needs a certain amount of skill, this drills holes independently on one side into the brush-back and on the other side fastens the bunches by means of wire loops into the holes, bored by the machine itself, so that the workman has only to take in and take out the brush-back and supply the machine with bristle material, all of which demands no special training. These automatic loop machines are made for fine, middle and coarse brush goods, with straight or oblique holes, and turn out an excellently finished product

within a very short time. To correct the cut of the ware made by this loop filling machine and by the loop automatic machine, there are various systems of cutting machines, with which almost every cut can be carried out.

The firm makes a speciality of machines for the manufacture of tooth-brushes, here also taking the lead, and constantly bringing novelties and improvements on the market. While in the case of the other brushes on the filling machines and automatics, the bundles of bristles are fastened in by loops of round wire, with tooth-brushes the bristles are generally attached by anchors which are automatically made by other-filling machines and automatics. It will be obvious that the manufacture of such machinery requires very special care from the nature of these very difficult anchors, the small holes, and the extremely thin bundles of bristles to be fastened in. To attach the bundles by the ordinary anchor-filling machines, the holes in the back of the brush must be previously bored on a separate boring machine. The manufacturers supply for this very purpose a multi-spindle boring machine which can be easily manipulated by any workman. Holding the previously bored brushes so that they can take the bundles of bristles must also be effected by hand as in the case of the ordinary brush-filling machines. This requires rather more skill than with the loop-filling machine. Accordingly increasing preference is being shown for automatics. These like the automatic loop-filling machines previously bore the holes in the brush on the one side also automatically, and on the other side automatically fasten the bundles by means of small anchors.

Anyone not familiar with the details of brush-making cannot be but surprised by the great technical and special knowledge necessary to keep up to the mark and by all the

thought and work expended till the industry was brought comparatively quickly to the point of perfection it has now attained. (Industry)

The industry can be started with a capital ranging for Rs 500 to Rs 50000 according to the class of brushes required to be manufactured. Complete figures can be had by writing to the manufacturers of machinery for brushmaking.

Training Institutions.

St. Francis Xaiverrer's Iudustrial School, Tanjore, Madras is the only institution as professes to impart a training in the art and no fees are charged there. In England, Pudsey Technical School, Leeds, has a course in brush making.

The following are some of the important brush factories in India where a practical training in the art be taken as an apprentice:—

Aryan Brush Co., Dadar, Bombay. (Hair Brush.)
Baroda Brush Factory, Baroda.
Bevas & Co, Cawnpore.
Brushware Ltd., Cawnpore.
Calcutta Brush and Fibre Factory, 172 Bowbazzar, calcutta.
Calcutta Horn Mftg., Co., Calcutta.
Ganga and Co., Meerut.
Hygienic Brush Factory, Bombay.
Indian Brush Co., Lower Parel, Bombay.
K. H. S. Brush Co., Ahmedabad.
Madras Brush Works, Wall Tank Road, Madras,
Punjab Brush Factory, Delhi.
Satya Narain and Co., Agra.
Star Brush Works, Madras.
Yeshwant Rao Brush Factory, Indore.

Bristles Merchants in India

Barlow & Co.; 37 Strand Road, Calcutta.
Indian Bristle & lard Supply Co., 31-1 Tangra Road, Entally, Calcutta.
K. L. Mehta & Co., Cawnpur.
Narayan & Sons, Patkapur, Cawnpur,
Volkart Brothers, Armenian St., Madras.

Brush Making Machinery Manufactures.

Bayer Konrad, Nurnberg, Germany.
Modern Broom Machinery Co., Devonport, Iowa, U. S. A
Neiman Machine Works, Freeport, Ill. U. S. A. (wire twisted brushes).
Shaw Ltd., 32 Hanóver St., Manchester.
Stevenson & Co., 607. S. Caroline Baltimore, Mo. (U. S. A.)
Solid Back Brush Machinery Co., 640 Lelane, Detroit. Mch. U. S. A.
Trevor Mfg. Co., 168 Market Lockport, N. Y., U. S. A (Backs and Brush handles).
Zahoransky A, Todtnau, Germany.

Books.

Kiddier, W.—Brush maker, (Pitman).
Kiddier, W.—Brush maker and the secrets of his craft and his romance.
Mason, C. T.—Chinese bristles used in Paint Brushes.
Profitable Industries (published by the Industry Book Depot, Calcutta.)

Journals.

Brooms, Brushes and Mops, Milwankee, U. S. A.
Brush Making, London. Ec 4.

Button Industry.

The button is a common and familiar object, but comparatively little has been written concerning it; assuredly it cannot be said to have a literature of its own. There is plenty of fugitive information, but apparently the button has not been a source of inspiration to many writers. The button have been in use for thousands of years in certain but they never had a chance of becoming indispensable until purely modern clothing came into vogue. Originally the button was the pure product of craftsmanship but to-day it has been caught in the universal whirl of mass production. During the last twenty years striking advances have been made in the methods of producing buttons of every quality. Birmingham has been the real home of the button trade of the world and every other central country has big factories for manufacturing button.

In India buttons were made in old old times of gold and silver for the rich. Later on ivory and ornamented horn buttons also came into use. But with the advent of British rule in India buttons for coats, shirts, etc., have been in great demand in this country. We buy 18 lacs rupees worth buttons from Japan, Germany, England and America annually. But since of late the shell button industry highly developed especially in Bengal and Bihar and with the advent of Swadeshi Movement it is making a steady progress. Dacca is the chief centre for the manufacture of buttons.

The Parreysia and Lamellidens are two kinds of shells that are used in the manufacture of buttons and ornaments in India and they are obtainable from Bengal.

The Department of Industries, Bengal has prepared a scheme for making mother of pearl buttons on a co-operative basis, the total capital required for equipment being Rs. 10,000. On application to the Department a copy of the scheme be sent for.

Shells are obtainable from fishermen of Darbhanga, Muzaffarpur and Dacca districts.

A complete set of hand machines for making iron, brass and zinc buttons, with a set of tools for producing trousers and buttons also, can be had from Taylor and Challan of Birmingham for about £ 75 c.i.f. Karachi.

Dr. J. L. Sarin M. Sc., Chemist to Punjab Government writes :—

There is not a single button factory in the Punjab. Our present requirements are met mainly from imported buttons. The total value of imports during the year 1930-31 is shown below :—

Class of buttons.	Imports through Karachi.	Total imports into India.
Metal	Rs. 16,068	Rs. 6,69,413
Other sorts	Rs. 1,92,690	Rs. 11,17,665

Buttons are made from a large variety of materials of which the most important are galalith (synthetic product from casein), corozo (a plant grown in South America), ivory, metals (aluminium, brass and copper), mother of pearls, horn and bone. The imported buttons are mostly made from galalith and corozo.

A scheme for the manufacture of buttons from horns, which are available in abundance in the province, is given below. Most of the machines mentioned therein can be used for the manufacture of buttons of other kinds, except metal. The process of manufacture is practically the same in all cases.

HORN BUTTONS

Raw Material

India is the only country in the world where suitable material for the manufacture of horn buttons is found. The horns available here show such characteristic signs and depth of colour as are not found in horns of any other country. Buffalo horn is the best of all horns for the manufacture of buttons. Our province is very rich in this material. It may be noted that button produced from horn are costly. But if a big factory with modern machinery were set up, and buttons were produced on mass scale, it is likely that the cost of production may be reduced sufficiently to compete successfully with the cheap and inferior foreign makes.

Process of Manufacture

Horns are composed of two parts, hollow and hard. Approximately about $^{2}/_{3}$rd of a horn is hollow aud $^{1}/_{3}$rd hard. The first operation in the manufacture of buttons is to cut off the hard part (commonly known as tips or full ends) from the hollow part. The tips can be used directly to make buttons while the hollow part should be prepared or treated as *Perlitta* buttons. The process of treatment is as follows:—

The hollow part is cut open at the thinnest spot on the circular saw. The cut horns are then put in hot water and allowed to stay there for some time, or for quick manipulation they are shaved. The shavings while still hot are pressed by hydraulic hot and cold plate presses to the shape of plates. Before use these plates are sorted according to shade and allowed to stay in water for some hours. For the softness of buttons the solid tips and plates prepared from hollow horn are first put in the

blank cutting machine. The blanks are either turned or pressed, dried and finally polished in the machines enumerated below.

Machinery Required

The list of machinery required for a factory capable of producing about 100 gross of buttons daily is given below:—

*2	Saws ...	Rs. 336
1	Hydraulic Press ...	Rs. 1808
1	Steam boilor ...	Rs. 1050
*4	Blank Cutting Machines ...	Rs. 1952
*6	Turning Machines ...	Rs. 2400
*1	Embossing Press complete with die ...	Rs. 412
*3	Drilling Machines for drilling the holes ...	Rs. 4984
*4	Scouring Machines for scouring the buttons before polishing ...	Rs. 1312.
*2	Barrel Polishing Machine for polishing the buttons ...	Rs. 656
2	Polishing Spindle Stocks for high glass polishing ...	Rs. 472
1	Tool Grinding Machine ...	Rs. 240
	Spare parts ...	Rs. 400
	Motor shafting, other accessories etc. ...	Rs. 1500
	Total...Rs.	17,522

The machines absolutely essential are those marked with an asterisk (*) above. The rest may be added gradually.

The manufacture of metal buttons may also be undertaken with a small additional investment of approximately Rs. 2000. In the manufacture of bone buttons there will be a good deal of waste bone, which can be utilised profitably

by adding to the button making plant a small bone crushing mill for the production of bone meal as a bye-product. Such a plant will cost about Rs. 15,000.

Building

A building with a floor space, 60′ x 25′ will be required. Such a building with saw tooth roof will cost about Rs. 4,500

Labour

For working out the above factory the following hands will be required:—

1	Expert @ Rs. 150 per mensem	...	Rs. 1,880 p. a.
1	Foreman @ Rs. 75 „ „	...	Rs. 900 „
20	Factory hands @ Rs. 20 each	...	Rs. 4,800 „
2	Clerical Establishment @ Rs. 75	...	Rs. 1,800 „

No expert for button making is available locally. He will have to be imported either from abroad or from Dacca. It would be advisable if training in the manufacture of buttons were obtained by one of the promotors of the button making concern. It will be possible to secure an Indian expert on a salary of about Rs. 150 a month.

Foreman

A local trained mistri or a properly educated Machanical Engineer would suffice. He may be employed on a salary of about Rs. 75 a month.

Labourers

Trained labour accustomed to handle various machines in an ordinary machanical workshop would do. Such workers could be secured for about Rs. 20 per month.

Economics of the Industry

A hypothetical balance sheet of the factory during the first year of its working is enclosed.

Debits.		Credits.	
1. Cost of raw material...1440 maunds @ Rs. 4 a maund	...Rs.	5,760	Sale price of 30,000 gross of
2. Wages including managment	...Rs.	9,300	buttons to an
3. Cost of motive power	...Rs.	5,400	average price of
4. Rent, Rates and Taxes	...Rs,	500	Rs. 1/8 net per
5. Repairs to plant and machinery	Rs.	1,000	gross after all
6. Depreciation to plant—18,000 @ 10%	...Rs.	1,800	deductions, commissions etc.
7. Depreciation to building—5,000 @ 2%	...Rs.	100	
8. Other charges accidental etc.	...Rs.	6,000	
To profits	...Rs.	15,140	
		45,000	Rs. 45,000

Director of Industries of Travancore writes:—

Every year from 10 to 30 thousand shank shells are being exported from Travancore to other parts of India. Government gets a royalty of Rs. 10 on every 100 shanks exported. The railway freight to Calcutta is Rs. 5 or if by steamer Rs. $3\frac{1}{2}$ per 100 shell. These are used in Calcutta and the neighbouring districts for the manufacture of buttons rings, bangles, etc., and the Industry is carried on under the auspices of Home Industry Association. Dacca is the centre of the pearl button industry and such is the cheapness of the process that prices from 12 As. to Re. 1 per gross are charged. It is essentially a cottage industry and is a very lucrative one. Three pairs of bangles are made out of each shell and are sold at Rs. 5 per pair and each

ring at Re. 1-8. Cuff links are made out of cowries and sea-mussel shell which are obtained all the year round. Shank shell are obtained only for six months in the year. River mussel shells, which are thicker and exist in plenty, can also be made use of in button making and are so used in Bengal.

In Bengal there are 17 villages consisting 161 families of 1500 men and women, engaged in bangle and button making. The tools used are very simple and inexpensive and are a file, a pair of pliers, a grindstone, a small table (even a box will serve the purpose) a hand drill with counter sink bit as well as a hole drill. These are all of local manufacture and are of rudimentary design. The whole industry is carried on in the cottages of the people.

Polish is given to the finished products by boiling them in kerosine oil for about 20 minutes under pressure, then rinsing in water and again washing quickly in boiling dilute nitric acid and drying in sun. This process is rather dangerous; but better ones exist which are kept secret. However, these can easily be found by a little experimental work. More than 1000 men sell buttons weekly in local bazars and each gets as much as Rs. 2 to Rs. 3. The total income thus derived from this industry in Bengal is more than a lakh of rupees per annum scattered among the many workers and averages Rs. 5 per mensem for each person.

This industry could easily be started here since labour is cheap. The people around the sea coast whence the shank and other shells are obtained, are very poor and they starve in bad weather for want of work and money. With great advantage the button industry could be carried on in Travancore along the coast as a cottage industry for these people. The earnings of a button worker could be from Rs. 5 to Rs. 10 per mensem. If the poor fisherfolk along

the coast were enabled to earn this amount, their condiiton would be improved to a great extent. The young members of the community are forsaking the calling of their fathers chiefly because of its dangerous and onerous nature and also because of the pecuniary and social advantages they derive by going to estates after finishing their primary education. These people would stay at home and direct their attention to this industry if it be profitable. Mr. L. A. Netto of Valiathoray has been permitted by Government to start this industry and the Department of Industries arranged for his man to be trained at Messrs. Bose & Sons, Button Factory, Madras at Mr. Netto's expense. A free place was secured for the man and he has now returned.

It is proposed to set up a factory for about 30 Button makers and also have two comb machines. Bones of all kinds can also be used and the refuse could be crushed for bonemanure. This will be a paying business. The buttons are sewn on the cards by women and are ready for use. To establish this industry it is essential that the supply of raw materials should be ensured for the Travancore Factory. His Highness' Government has quickly recognised this and granted Mr. Netto the license to collect the shells for 20 years on conditon that he starts the industry within 12 montns and continues to work it to the satisfaction of Government.

Horns and bones of all kinds can be utilised and it is hoped that this will be done. Samples of elephant bone buttons and shell buttons have already been made by this Department. River Mussel Shells are also to be utilised for this purpose. A comb machine is very simple and consists of a circular saw rotated by hand power with a moveable platform. As this works up and down, the teeth of the comb are cut and at the completion of each cut, a lateral

progression is made by means of the turn of a handle so as to bring it into position for the next cut. The polishing of the bone buttons and combs is done by wet leaves and fine emery powder.

In Japan buttons are being made in moulds out of a pulp composition made of vegetable matter.

Button Making Machinery Manufacturers and Suppliers

The Baird Machine Co, Bridgeport, Conn. U.S.A. (for Metal Buttons).

Patent Button Works Co., Waterbury, Conn. (attaching).

Waterbury Button and Manufacturing Co., Waterbury, Conno (Cloth Button Covering).

Bary Co., Muscature, Iowa, U.S.A.

Grims and Harris, Leominsters, Mass (Horn),

Zeh and Hahnemann Co., Newark, N. J (Metal).

Holun-Dusha Co, 1799 1st Ave New York City U.S.A (Celluloid, Pearl, Ivory, Horn,Galalith, Bone etc)-

G. N. Tanner, Kings Road, St, Panoras. London N.W.I. (Bone, Ivory, Horn, Wood).

Industrial Manufacturing Co., Clive Street, Calcutta.

Oriental Machinery Supply Co,, Calcutta.

W. R. S. Button Co., Hanbury Street, London E.I. (Button moulds, press, dies etc.)

Buttons Manufactruing Concerns

Behar Industrial Button Factory, Motihari, Champaran.

Button Manufacturing Co. Jaipore.

Calcutta Horn Manufacturing Co., 19-3 Harrison Road, Calcutta.

Dacca Button Manufacturing Co., Ltd., Mercantile Buildings, Calcutta.

Dutta Button Factory, Dacca.

East Bengal Button Factory, Dacca.

Eastern Small Industries, Laxmi Bazar, Dacca.

Gold filled Button Manufacturing Co. Kalbadevi Road, Bombay.

Jessore Comb and Button Factory, 20-1 Lal Bazar Street Calcutta.

Kohinoor Horn Button Works, Dacca.

R. S. Wadaye Bros, Lohar Chawl, Bombay'

S. Chand Bros. and Co., Bangala Bazar, Dacca.

Books

Button and Bangle-making from Chank Shells. (Deptt. of Industries, Travancore.)

Foreign trade in Buttons.

Jones, W. U.—Button Industry. (Pitman).

Large uses of steel in small ways ; Buttons.

Money in Handicrafts. (Industry Book Depot.)

Journals

There is no journal especially devoted to this industry, but articles appear from time to time in journals on industry, metal trades, horn trades etc.

Cigarette and Cigar Manufacture.

Every modern device has been adopted to exploit the seemingly natural tendency towards cigarette smoking and the result of all this and the tremendous increase in cigarette smoking engendered by the war has been to bring cigarette production upto a figure which seems almost incredible.

The vogue of cigarette goes back to less than half century. In 1870 one James Bonsack produced a Machine, the first of its kind which manufactured cigarettes at the rate of 180 per minute. Now the latest type turns out 1200 per minute, the record put out for one machine being about 5,30,000 in one day. First the cigarettes were plain, then printed, then gold tipped, then cork tipped which has become popular to-day.

In India the cigarette smoking has increased by bounds and leaps inspite of the fact that the hooka smoking is still adhered to by large classes of people. The one brand of Indian Tobacco Co., Ltd., made a sale of Rs. 85,24 of cigarettes in December, 1929, in the city of Lahore alone. And there are innumerable other compaines like these.

In the words of Dr. Shaw D Sc. of Pusa;

"At present the total production of tobacco in the world may be estimated at approximately 4,900 million pounds of which quantity about half is produced in the British Empire and the United States of America. Among the producing countries of the British Empire, India has by far the largest place producing about 20 per cent. of the world's total production and about 90 per cent. of the total of the

British Empire. In spite of the large production, nearly 1,000 million pounds of tobacco in India, this country does not take a proportionate share of the international export trade in tobacco. The leaf produced in India is generally of a coarse heavy type with a dark colour and strong flavour, as such it suits the local market and the bulk of the crop is consumed in the country.

The advance of the cigarette popular favour in recent years has been world-wide. In the United Kingdom alone the figure was:—

	1907 per cent.	1924 per cent.
Cigarette ...	23. 8	58. 5
Pipe tobaccos ...	71. 1	40. 0
Cigars ...	5. 1	1. 5

The rise in the consumption of cigarettes, at the expense of pipe tobaccos and cigars, is striking and it must be a matter of observation to any resident in India during this period that a similar change is taking place in this country,

It is evident that if a good quality cigarette tobacco can be produced in India it will be assured of a ready market in this country, apart from the advantages accruing to all Empire tobacco in the market of the United Kingdom owing to the preferential tariff. The difficulties in the way of the production and sale of such a tobacco in India may be classified as follows:—

(a) the cultivation of the required type,
(b) curing,
(c) marketing,

The most important qualities in a good cigarette tobacco are a light yellow colour, a mild flavour, good burning qualities and a certain elasticity in the cut tobacco. Colour is perhaps the most important factor, since flavour

is generally closely related to it. A light yellow or "bright" tobacco may possess a flavour which makes it suitable for use as a cigarette tobacco but a dark leaf is practically always a strong and coarse flavoured smoke, suitable for pipe and *biris* but useless for cigarettes. Burning qualities are next in importance and a cigarette tobacco must burn easily and not give a hot smoke. Elasticity depends largely on the capacity of the cut tobacco to retain a certain amount of moisture ; without this property the tobacco in a cigarette will dry to powder and fall out leaving an empty paper cylinder.

None of the indigenous tobaccos of India possess the properties of a good cigarette tobacco. They practically all yield a dark coarse leaf giving a strong and pungent smoke, as such they are suited to some of the requirements of the local market in India, but they cannot meet the demand for a cigarette tobacco and they do not find a big demand in other countries. Up to the present the best Indian cigarette tobacco has been the Pusa Type 28. This, however, cannot, be cured to a bright colour and possesses a disagreeable flavour which makes it unsuitable for use in any but the lowest grade of cigarettes. The production of of a high grade cigarette tobacco in India involves, therefore, in the first place, the introduction and acclimatisation of a new type of tobacco, with a study of the conditions of cultivation suited to its successful culture in India. This must be accompanied by experiments in curing and maturing the leaf and by an enquiry into the economics of the process.

One of the best of the cigarette tobaccos grown in the United States of America is that known as Adcock. This variety grows and cures well in America and forms the basis of some of the most popular brands of "Virginian"

cigarettes in the world. Adcock was first introduced into India on a large scale by a commercial organisation operating in the Guntur District of Madras where it was found to grow well, to give a good yield, and to cure to a fairy light colour, inferior, of course, in this latter respect to the Adcock leaf produced in America but greatly superior to anything of this type which had previously been produc- in India. Adcock tobacco grown in Guntur gives a leaf which can compete with the cheaper grades imported into India in the manufacture of medium quality cigarettes for consumption in the Indian market. At the present moment it is cultivated on about 25,000 acres in Guntur District and appears to be one of the most successful examples of the introduction of a new plant to the agriculture in this country. Adcock tobacco also grows and yields well in Bihar and has been the subject of experiment of Pusa during the last 5 years.

With the succcessful introduction and cultivation of a good cigarette tobacco accomplished the next problem is that of curing. The indigenous methods of curing are all dependent upon climatic heat and dryness and as such are under the control of the operator. For the production of a good quality bright cigarette tobacco the whole process of curing must be under control and independent of climatic variations. The only reliable way in whlch tobacco can be cured to a bright colour in India is by means of a flue-curing barn, in which the tobacco is dried by artificial heat and in which the conditions of temperature and humidity are under control. Researches at Pusa have shown that this can be done and that the cost of curing is small in relation to the value of the product. After curing in the barn the tobacco is fermented in heaps and is then ready for sale.

The marketing of flue cured tobacco in India is subject to a limitation which perhaps does not exist in the case of

any other agricultural product. After curing and fermenting the tobacco must be passed through drying machines in order that it may contain a definite percentage of moisture. These machines are large and expensive and few exist in India ; the sole market for flue cured tobacco, therefore, is with the commercial organisation which maintains such machine in India. The wider aspects of the marketing of a home grown cigarette tobacco in India have already been touched upon in this article. The first result of the development of this branch of the tobacco trade would be the replacement, in part, of imports of foreign leaf, chiefly from the United States of America, by the Indian grown product. Surplus production beyond the demand of the Indian market would be available for export to the United Kingdom where the preferential tariff on Empire tobaccos accords a favourable position to all leaf grown within the British Empire.

The increased development of an export trade in cigarette tobacco to the United Kingdom is entirely dependent upon success in the production of tobacco of the required quality. Hitherto, however, most of the tobacco imported into the United Kingdom from India and other Empire sources has been of the darker varieties most suited for use in pipes.

Imports of unmanufactured tobacco almost wholly meant for consumption in the local factories amounted to 2.8 millions lbs. out of which U. S. A. supplied 87 per cent. Foreign cigarettes, however, continued to lose in public favour and imports declined for 3.1 million lbs. valued at Rs. 1,22,50,000 to 1.4 millions lbs. valued at a Rs. 5278,000. Out of these 83 per cent. of the total quantity of cigarettes imported came from the United Kingdom. Receipts of low grade cigarettes from China was a new feature of the trade in the line in recent year and valued at Rs. $2^{3}/_{4}$ lakhs.

Cigars and tobacco for pipes and cigarettes imported was 21,400 lbs. and 129,400 lbs. respectively in year 1931-32. Tobacco exported during 1931-32 amounted to 26,261,000 lbs. valued at Rs. 85,42,000. Out of these cigars manufactured valued at Rs. 1,32,000 and unmanufactured tobacco at Rs. 80,62,000. These figures clearly speak of the potentialities in the development of the trade.

The Department of Industries of Bengal has issued a very useful pamphlet in cigar making, out of which we take the following extracts;

"Cigars are manufactured according to certain types commonly recognised in the trade, the sizes varying from $3\frac{1}{2}''$ to $7\frac{1}{2}''$ in length, and the type depending upon the length, thickness and contour of the cigar.

The quality of cigars depends on the following important points:—

(1) the burning qualities, (2) the aroma, (3) the flavour, (4) the colour ; and (5) the workmanship put into them.

The burning qualities of a cigar are most important. If it does not burn properly, super-excellence in all the other qualities cannot compensate. The cigar must hold fire for three or four minutes. The tobacco must be consumed evenly on all sides and there must be no thick black ring of carbon where the tobacco meets the ash.

Aroma and flavour depend upon popular taste and the producer responds to the vagaries of the market.

The colour should neither be too pale nor too green. Greenness shows that the tobacco has not been sufficiently cured.

It is not only the appearance of the cigar but its success as a whole depends on the care taken in its manufacture. If the leaves are not laid properly longitudinally, the "draw" will be impeded and the cigar a failure. A good cigar

should be smooth and even, without any cracks. It must feel firm when squeezed or otherwise it will become spongy when half smoked.

In this scheme it is assumed that the cigar factory can obtain the necessary quantities of properly cured tobacco leaves which it requires. The curing of tobacco is, of course, one of the most important considerations in the process of converting the growing weed into the finished cigar. But successful curing depends upon properly treating the leaf from the moment it is cut in the field. Prolonged exposure to the sun leads to deterioration of quality from the start. Hence it is incumbent upon the grower to arrange for the curing of his own tobacco. This he now does, but more or less indifferently. With the advent of a factory in close business relations with tobacco growers, and as a result of curing processes and methods evolved at the Agricultural Department's Burirhat Farm, it will be possible to extend the supply of satisfactorily cured tobacco, but this part of the business is more closely related to the growing of the leaf than to its manufacture into cigars. Curing requires suitable dark storage accommodation and it may be that where individual resources are insufficient co-operative efforts for tobacco curing will meet the need. The Agricultural Department is endeavouring to promote such development. It seems certain that if the factory creates the demand for cured tobacco of quality, the supply can be obtained ; and the same position obtains as regards quantity of suitable tobacco leaf available. At the moment (1922), the full requirements of Sumarta tobacco and Manila and American varieties are not available, but the regular and growing demand for such, together with the help of the Department of Agriculture would rapidly establish a satisfactory supply.

Tobacco used. The following classes of tobacco leaves are used in the manufacture of cigars. They are obtained by sorting the leaves in three grades:— (1) Wrappers. (2) Binders. (3) Fillers.

Wrapper tobaccos must be silky in texture, elastic and strong, with regular veins and fine grains and without any pronounced flavour. Sumatra leaf, as grown in Rangpur, possesses these characteristics satisfactorily. The leaf used as a binder is of the same variety as that used as fillers or as a wrapper ; leaves containing slight flaws are used as fillers or as a wrapper ; leaves containing slight flaws are used as binders. The filler is the tobacco which forms the bulk of the cigar and gives it its flavour. Cuban and American tobacco are commonly used for this purpose, but in Bengal (Rangpur), Sumatra seed leaf has proved to a certain extent successful in this direction. The Agricultural Department are carrying out detailed experiment this year with Manila, Pennsylvania and other varieties, and hope to be in a position to recommend an even better filler than Sumatra shortly.

Process of manufacture..—Tobacco leaves are first sorted into three grades according to the soundness and length of the leaf. They are then dipped in sugar or *gur* solution, drained and left for one night wrapped in wet gunny. In the morning the leaves are unpacked and midribs are taken off. Rolls for wrappers are made out of sound leaf, the lower grade leaves being selected for binders, while torn and unsound leaves are used for fillers. The processes of manufacture may be detailed as follows:—

(1) Damping and stripping the leaves. (2) Rolling the half leaves of the wrapper tobacco into bundles so as to smoothen the leaves. (3) Preparing the fillers. (4) Fixing the wrappers. (5) Cutting the ends. (6) Packing the finished cigars.

The tools used by the cigar-makers at Ranpur are not extravagant. They merely consist of a table, a hard wooden board, a sharp knife, a gauge and a pot of fixative. The latter may be Gum Tragacanth, sago paste or flour paste.

There are two operatives, one who finishes off the cigar with the wrapper and the other, generally a boy who makes the filler and ties it up in the binder.

The tobacco is left dampened overnight, and in the morning the wrapper tobacco is rolled tightly into bundles to smooth the leaf out. It is then kept alongside the operative and used as required. The poorer leaves are sorted out as binders and handed over to the boy.

The boy takes a number of filler leaves, lays them longitudially in the binder, binds them up into a rough cigar and lays it beside the man who does the wrapping.

The latter selects a leaf from his bundle of wrappers and deftly cuts it into shape.

He picks up the roughly formed filler, rolls it round in his palms into what is called the "Bunch" till it forms the shape of the type or cigar to be produced, and then commence to put on the wrapper. In putting on the wrapper he starts at the lighting end of the cigar and finishes at the end which one puts in one's mouth called the "Head."

The fixative is used to hold the leaf at the "Head" and the operative then takes the cigar and places it alongside the gauge and trims it off neatly at the smoking end, to the length required.

The cigars when completed are sorted out into bundles containing 25 and packed into the standard boxes of 50 or 100. They should then be kept in a suitable aging store.

From what has been stated about, it will appear that the processes are not very intricate and that for these

reasons the industry is one which has been developed as a cottage industry. There are difficulties, however, inasmuch as the brands of cigars for which a reputation in the market is desired must be consistent in quality and flavour from year to year. This necessitates careful supervision, particularly in the blending of the tobacco. On the whole, therefore, it would be better to develop the industry in small factories as has been done successfully in Madras.

Description of methods adopted for the control and supervision of labour for the manufacture of cigars in several places.—In Burma cigars are, as a rule manufactured on cottage industry lines by small families. They are collected by a central agency which controls the process of aging and sorting and other subsequent operations for presenting them to the market. In Madras cigars are manufactured by well established firms in small factories with local labour on the piece-work system. In Bengal, the work done at the Government Agricultural Development Company, Limited, is on the monthly emolument basis. The daily output of cigars is, in consequence, very low and the system of payment prevents development on a commercially sound basis. Expert supervision is essentially necessary for better result.

Estimate for a small cigar factory.

Annual outturn .. .. 1,5,00,000 cigars.

(*a*) *Buildings.*

		Rs.
3,000 sq. ft. at Rs. 5 per sq. ft.	..	15,000
Implements (lump sum) ...	..	400
Racks and furniture (lump sum)	..	2,000
Land, workmen sheds, well, latrines and miscellaneous expenses (lump sum)	..	7,600
Total	..	25,000

(*b*) ***Monthly expenditure.***

Materials.—

		Rs.
Tobacco 22 maunds fillers at Rs. 20 per maund	.. ..	440
Tobacco 5 maunds wrappers at Rs. 100 per maund	.. ..	500
Rum 54 bottles for Nos. I and II cigars at Rs. 3-8 per bottle	..	84
Sugar Gum Tragacanth, flavouring materials, paper, etc.	..	100
Boxes 2,10 at Rs. 20 per 100 including fitting, fixing complete	..	420
Fuel, carriage and contingency (lump sum)	.. ...	126
		1,670

Labour and Supervision.—

		Rs.
Expert, Rs. 350—25—500	..	400
3 men for handling raw materials and for packing, etc., at Rs. 20 each	..	60
2 Master Rollers for sorting and supervision at Rs. 40 each	...	80
Clerk	.. ...	45
2 Menials at Rs. 12-8 each	..	25
Labour for 125,000 cigars at Rs. 7 per 1,000 cigars (average)	..	750
		1,360
Total	...	3,030

(*c*) ***Total capital.***

A period of 8 months is necessary to complete a cycle of operation from manufacture to disposal so the working capital required is:—

		Rs.
8×3,000=Rs, 24,000, say	...	25,000
Capital outlay ...	...	25,000
Initial expenditure for first two years for training, labour, etc.	...	30,000
Total	...	80,000

(*d*) *Monthly outturn.*

		Rs.
No. 1 cigars 45,000 at Rs. 4-8 per 1 00	...	2,025
„ 9 „ 35,000 „ 3-8 „ „	...	1,225
„ 3 „ 45,000 „ 2 „ „	...	900
Monthly sale	...	4,150

(*e*) *Profit and Loss Account.*

Receipts.

	Rs.	Rs.
Yearly receipt from sale		... 49,800
Less $2^1/_2$ per cent. wastage	1,245	
And 10 per cent. commission on sale ...	4,980	
		6,225
Net yearly receipt from sale		... 43,575

Yearly expenditure.

	Rs.	Rs.
Materials and Labour		... 36,360
5. per cent. commission of purchase of tobacco ...	564	

Brought Forward	564	...	36,360
5. per cent. depreciation on capital outlay	... 1,250		
			1,814
Total yearly expenditure		...	38,174
Net yearly profit, or 7. 5 per cent.		...	5,401

M/s Burn & Co., Ltd., of Howrah have submitted us the following estimate for plant to produce 3,00,000 cigarettes per day.

Item A. 1 Vertical Steam Boiler size 6′×2′—6″ complete with all Mountings, Tools, Valves, and Fittings and with special pressure reducing Valve to suit 40 lbs. per square inch.

„ B. 1 Type 161 Leaf Steaming Pan size 6′×2′—6″ complete with Waste Water Ejector and necessary connecting pipes.

„ C. 1 Type 157 10 gallon Leaf Moistening Spray.

„ D. 1 Type 74 Automatic Emery Knife Grinding Machine complete with Electric Motor and Starter.

„ E. 1 New No. 3 size Tobacco Cutting Machine with 5″ width of Mouth and Wood-covered Drum, complete with all necessary Ratchet Change Feed Wheels, Tools and Knife, Motor and Starter.

„ F. 36 Best Quality Knives for above.

„ G. 1 Type 163 Steam Heated Drying Pan size 6′×2′—6″ complete with Waste Water Ejector and necessary connecting Pipes.

„ H. 1 Type 166 Cooler for Cut Tobacco size 66″×32″ complete with Motor and Starter.

Item J. 5 Type 175 Tinned Steel Trolleys with Tops for carrying out Tobacco

„ K. 5 Special Trolleys for storing Cigarette Trays, Type 174.

„ L. 1 Circular Knife Grinding Machine type C. G. complete with Electric Motor and Starter.

„ M.100 Special Cigarette Trays.

„ N. 5 Special Trolleys for storing Cigarette Trays, Type 174.

„ O. 1 Cigarette Splitting Machine for Waste Cigarettes complete with Electric Motor and Starter.

„ P. 1 "Standard" Cigarette Making Machine with 2 colour Printer and Bronzer, complete with garnitures for one size Cigarette and with 3 H. P. Electric Motor and Starter, approx, spare parts for Machines.

Including spare parts for the above machine and Total Cost Rs. 37,698/- Nett, F.O.R. Karachi.

Delivery:—10/14 weeks from date of receipt of order.

Shipment from London of any or all of the items for which we quote could be effected in $^2/_3$ weeks from date of receipt of order. Should an erector be required for assembling M/s Robert Legg Ltd., would be prepared to send out a first class man to handle this job at Rs. 270/- per week plus 2nd class passage out and Home.

A smaller machine capable of producing 180 cigarettes per minute (Model C. P.) can be had of M/s Bombay Berlin Handelsgesellschaft Dalal Co., McLeod Road, Karachi at $ 3073 net exgodown Karachi. This is specially suited for places where skilled labour is not always available. This can be operated upon by a layman.

Cigarettes and Cigars Machinery dealers:—

American Machinery and Foundry Co., 5522, 2nd Ave, Brooklyn, N. Y., U. S. A. (Automatic).

Bonchur Cork Co., 345 W 40th, New York City, N. Y. (*Cork tipping*)

Borgfeldt Brass Co., Metuchen, N. J., U. S. A.

Comas Cigarette Machine Co,. Salem (U. S. A). (*Making, Packing etc.*)

G. Hatterstey & Sons, L 12, Kerghlay, Yorks.

International Cigar Manufacturing Co., 511, 5th Avenue New York City. (*Automatic Cheroot and Cigar Making, foiling etc.*)

Patent Cigrarette Making, 26, Hatton Wall, London E. C. 1.

R. Legg L 11, 49 Eagle Warf Row, London N-1.

United Cigarette Machine Co., Inc. Lynchburg, Va, (U. S. A.) (*Cork and gold tips*)

Cigar label Mnftrs.

Bruming Heiner and Aug. Hanan O/Maln (Germany).

Tobacco Cutting Machine Manufacturers

J. M. Lehmaun A.-23, Dresden, (Germany).

Cigarette and Cigar Mvnufacturing Companies.

Dindigal Cigar Co., Dindigal, Madras.

Gold Medal Cigar Factory, Worriur.

Gwalior Tobacco Works Ltd., Gwalior.

Howrah Cigarette Co. Factory, Howrah.

Indian Leaf Tobacco Development Co., Darbhanga.

Invincible Cigar Works, Worriur.

Krishan Shroop & Co., Thakar Dwara Road, Bombay.

Mysore Cigarette Manufacturing Co., Bangalore.

Oriental Tobacco Manufacturing Co., Kolaba, Bombay.

Pearl Brand Cigar Factory, Worriur.

Pradhan Tobacco Co., Gwalior (India's renowned factory).

Royal Indian Cigar Co., Worriur.

Satya Narain Cigar Works, Penugonda, Worriur.

S. I. Cigar Works, 285, Thanbuchetty St., Madras.

Thos. Cook & Co., Worriur.

Upper Sindh Cigarette Manufacturing Co., Sukkur.

Books

Indian tobacco and its preparations (Published by Industry Book Depot).

Profitable Industries (by Industry Book Depot.)

Scheme for a Small Cigar Factory in Bengal published by Bengal Secretariate Book Depot, Calcutta.

Tanner A.E.—Tobacco from the grower to the smoker.

Journals

Cigar and Tobacco World. London W. C. 2.

Tobacco Leaf, New York.

Tobacco, London W. C. 2.

Tobacco Trade Review, London E. C. 3.

Electroplating.

Electroplating is an industry of modern times. It was only in 1837 that Spencer and Jacobi, made use of the phenomenon of electrodeposition for practical purposes. The advantages of this idustrial art are now being properly understood by manufacturers. The World War gave the industry its due rank, when the manufacturers felt dearth of brass and copper, which were in demand for production of munition, and when they made use of electroplating in making use of other inferior and less inexpensive metals. Gold, silver, zinc, nickel, tin or copper are generally used for electroplating purposes.

As it is a rising trade and as it can be started with a capital of Rs. 1,000 to Rs. 15,000 according to work intended to be taken, the work is specially suited to youngmen who can secure work or who want to manufacture articles requiring to be electroplated. During 1931-32, India imported electroplated articles worth about 3 lacs of rupees.

Electroplating.

Electro-plating is the art of depositing one metal upon another through the action of electrolysis. It commercially serves the following objects:—

(i) Improving the appearance of an object such as depositing silver upon brass, German silver, or other metals, as is the case in "electro-plate trade", or depositing nickel upon iron or steel, as is the case in the cycle and motor trades.

(ii) Safeguarding against corrosion, e. g. the deposition of zinc or chromium upon steel or iron.

In commercial practice the plating undergoes three processes:—

(i) Preparation ; (ii) Deposition and (iii) Finishing.

(*i*) *Preparation.* This involves removing all oxides, grease, or such other foreign matter from the surface of an article which is to be plated, which is called (work) ; without this process the electro-deposited metal will not adhere to the base metal on which it is formed.

(*ii*) *Deposition.* In order to deposit one metal upon another electrically it is necessary to (1) Make a solution containing the metal which is to be deposited ; (2) Suspend in the solution the article that is to be plated and a plate of metal as is to be deposited ; and (3) Pass a current of electricity through the solution between the article that is to receive deposit and the metal plate. The former is named the cathode, the latter the anode.

(*iii*) *Finishing.* When plated the article is taken out from the solution and "dried out" that is it is passed through tanks first of cold water and then of hot water, and then thrown into and rubbed with hot sawdust till dry.

The plating plant required consists of:—

1. Some source of electric current and
2. The tank (smn. vat), that contains the solution,
3. The tank's accessories.

The sources of electricity in plating shops are:—

1. Dynamos or motor-generators which consist of an electrical machine for generating current. The dynamo is run either (a) by belting running between the drying pulley of the machine and a pulley fixed on line shafting or (b) by an electric motor coupled to it.

(*ii*) *Accumulators.* Employed in plating shops in order to supply current when the machinery in the shop is at a standstill.

Tanks. These are either of wood or iron, preferably welded. The wood vat is lined with sheet lead in order to prevent leakage, and the lead is covered with match-boarding to secure insulation. The iron vat should be covered with a close-fitting lining of asbestos board or other insulator; it should be stood on insulators. Wood vats are used for cold solutions and iron vats for hot ones. The source of heat for the latter may be either gas or steam.

All tanks must be fitted with wooden frames.

Accessories. These comprise:—

(i) $^3/_4$ in. to 1 in. brass rods or tubes, which should be laid on insulators fixed on the frame of the vat. They are odd in number. Those connected to the negative side of the circuit are called "Cathode rods". The articles to be plated are suspended from these. The rods connected to the positive side are the "anode rods", from which the anodes are suspended. Each cathode rod should have an anode rod on both sides of it.

(ii) "Rod connections," which enable the rods to be connected together or to the main leads from the machine by means of insulated copper cable.

(iii) Ammeters and voltmeters for measuring currents and voltage respectively.

(iv) Anodes.

Electrotyping.

In electrotyping, the object to be attained is as a rule the reproduction in copper of an object either in relief or intaglio. To accomplish this a mould or cast of the object to be copied is first taken by means of a suitable medium or composition. If the latter should not happen to be an electrical conductor, the surface to be reproduced must be

rendered conducting by the application of graphite or in some other way. Assuming that an exact copy in some plastic material has been secured, and that the surface is not so absolutely clean that the electrodeposited copper will adhere too firmly to it, then it is only necessary to make such a cast the cathode during the electrolysis of a copper sulphate solution. In order to maintain the electrolyte at the initial concentration, and also diminish the expenditure of energy, an anode consisting of pure copper should be employed when a film of sufficient thickness has been deposited, observing the general conditions necessary for the refining of copper, it is then detached from the mould and backed with fusible metal or otherwise as required. Electroplating on the other hand, differs essentially from electrotyping inasmuch as the film of electrodeposited metal is intended to adhere as completely and as firmly as possible to the object being treated. It is therefore necessary that the surface should be rendered smooth, bright, and in particular, clean, from the chemical point of view. This can, of course, be accomplished in various ways, which do not require to be specified. After acting as cathode in a suitable bath until a sufficiently thick film is deposited, then plated object is removed, washed and burnished mechanically when this is possible. Gold, silver, and copper for example are soft and easily burnished. Nickel, on the other hand, is extremely hard and difficult to burnish, so that the greatest care ought to be taken in obtaining a smooth, bright surface before electroplating.

As has been already indicated, the character of the deposited metal is influenced to a great extent by the current density employed, and by the rate at which the electrolyte is stirred or circulated. Since the latter influences the character of the deposit by maintaining a constant composition of the electrolyte in the neighbourhood of the

cathode, it will readily be understood that any variation of the concentration of the electrolyte will affect both the deposit and the permissible current density. Other factors, such as the acidity or alakalinity of the electrolyte, have naturally also to be considered in individual cases. If basic salts are objectionable, for example, the addition of acid would not only prevent their formation but also alter the resistance of the electrolyte. The addition cf various organic and other substances often in very minute quantity has sometimes a marked and hitherto unexplained influence on the character of the precipitated metal.

The temperature of the bath is another important factor. Increase of temperature in the case of a primary process influences the electrolysis in so far as it reduces the resistance of electrolyte. Secondary process on the other hand, are purely chemical, and as such are affected to a much greater extent by rise of temperature. The deposition of a metal from a complex salt, being a secondary and therefore a purely chemical process, is likely to be promoted by warming the bath, as for example, in gold and nickle plating with the above mentioned salts. Nearly all the metals, with the exception of the alkali metals, and magnesium, aluminium, etc. can be electrodeposited from aqueous solutions.

It should be also noted that the object of electroplating generally is either to embellish or protect the article. In the case of protection the metallic film should not only cover the object completely but it should also act as a true protecting coating. Gold or platinum, e. g., are not generally acted on by corrosives, and therefore act as efficient but expensive protections. The less noble metals behave more or less efficiently according to circumstances and paradoxical as it may appear, some exert an excellent protective action because they are more or less easily corroded or

acted on. A case in point is zinc. Iron or steel coated with zinc may or may not be efficiently protected from corrosion according to circumstances. Even although the film of zinc was imperfect steel would be effectively protected from corrosion provided that it was submerged in the corroding medium and that any considerable quantity of zinc was felt at all.

Both steel and zinc, for example, taken seperately, would be attacked by a dilute acid. In contact, however, they form a galvanic couple and zinc being the more positive metal would be attacked and dissolved in preference to the steel on the surface of which only hydrogen would be evolved ; so that as long as zinc is present the steel is protected from corrosion. For this reason it is now customary to protect the boiler-tubes, boilers, or hulls of vessels, etc., with zinc. This can of course, be done by dipping the parts in molten zinc according to the older process of galvanising, but the tensile strength of steel of high breaking load is thereby diminished. Electrolytic zincing or cold galvanizing on the other hand, can be done at the ordinary temperature. Galvanized articles, whether by the hot or cold process exposed merely to the atmosphere and not submerged in an electrolyte, are of course, not protected to the same extent. (Industry)

Investment.

The electroplating requires only a capital of Rs. 1,000 to be started on small scale basis. M/s Alferd Herbert & Co., Ltd., Lahore have submitted us the following estimate:—

6 Volts Dynamo 50 Amp	...	Rs.	220
Shunt Regulator with Voltmeter	...	„	30
Resistance Board with 50 Amp Ammeter	...	„	50

Polishing Lathe	30″	...	Rs.	57
	36″	...	„	82
	40″	...	„	85

Value of Salts, Brushes, Emery, Lustre etc. to depend upon quantity required, but all the equipment including the above machinery and a furnace should not cost more than a capitol of Rs. 1,000 to start a busines.

M/s. L. T. Pinto & Sons, Lahore have submitted us following estimate for complete electro-plating plant.

A. *Motor Generator Plant:* consisting of oneG. & W. latest type generator set, one starter, and one vat control panel. All the above instruments mounted on angle iron framework suitable for wall mounting.

B. *Chromuim Plating plant:* consisting of one welded mild steel plating tank: 5′×2′ 3″ ×4′ deep, two hardwood insulating ends for top of tank, three 24″ S. I. Atmospheric Gas Burners complete with angle iron supports and baffles for heating Tank, Chemicals for 25ogal hardwick Chrome Solution, 10 8%antimonial lead Anodes each 2′ 6″×6″×1/4″, 20 special lead covered copper suspension hooks, 3 solid anode and cathode rods each 5′ 9″×1″ dia, 6 solid gunmetal connection blocks, 1 semi-encased vat thermometer, and 1 G. & W. Hydrometer for testing solution.

C. *Swilling plant:*—One welded mild steel tank 3′ 6″×2′×3′ 6″, one galvanised tank for second swill (hot water) 3′ 6″ ×2′×3′ 6″ and one 19″ S. I. Burner for heating same.

D. One set of complete spray exhaust equipment.

E. *Copper nickel & silver plating equipment generater plant:*—One G. & W. latest type motor

generator set, one starter for motor side, and one parallel shunt regulator for controlling generator fields.

F. *Nickel plating plant:*—consisting of one lead lined plating tank 6′×3′×3′, chemical for 280 gals of hardwick nickel solution, 12 cast nickel anodes each 16″×9″×4″ 24, only nickel suspension hooks, three 1″ brass anode and cathrods each 6′ 9″ long,, four 1″ brass connection, six 1″ earthenware rode insulators, 1 vat control Panel, 1 Set of blue and red litmus books for testing solution, 2 vertical type lead covered gas solution heaters.

G. *Acid copper plant:*—comprising of, one lead lined plating 5′×2′ 6″×2′ 6″, Chemicals for 155 gals of Hardwick Aicd copper solution, 8 one rolled copper anodes, 16 copper Suspension Hooks, three 1″ brass anode and cathode rods 5′ 9″ long, four 1″ brass rod connection, 6 earthenware rod Insulators, and 1 vat control panel.

H. *Silver plating plant:*—1 lead lined plating tank 4′ ×2′ 6″×2′ 6″, Chemicals for 125 gal hardwick silver cyanide solution, silver anodes as selected, three 1″ brass anode and cathode rods each 4′ 9″ long, four brass connection, six 10″ earthware insulators, one vat control panel, one No. 12 earthenware tank for Mercury Cyanide quicking solution, and chemicals for 14 gals for hardwick quicking solution.

I. *General cleaning & swilling plant:*—consisting of one Welded Mild Steel Tank 4′×2′×2′, Chemicals for 106 gals hardwick cleaning solution one lead lined scouring and swilling trough 4′×2′×1′ 6″ one galvanised hot water tank 4′×2′ 4″×2′, one

galvanised iron sawdust pan 4′×2′×1′ 4″, three 19″ S. I. Atmospheric burners for heating the cleaning tank.

J. *Polishing plant:*—consisting of two latest type G. & W. double ended motor polishing lathe.

K *Sundries:*—

4 Cwt. Hardwick chrome salts for replenishing chromium solution,
4 Doz. 726 best qual scouring brushes,
2 Doz. 4 row potash mops (long handles,)
4 Doz 10×135 No. 3/a mops for polishing brass copper and nickel,
4 Doz. 10×90 No. 1 mops for finishing brass copper and nickel,
2 Doz. 10×1 No. 7 mops for polishing silver,
5 Cwt. No. 3 Tripoli Composition for polishing brass copper and nickel,
2 Doz. tins No. 4 white finish for finishing brass copper and nickel,
2 Cwt. No. 5 white finish for polishing chromium,
6 Bars J xx Rough Composition for finishing silver,
1 Only plain bearing scratch brush lathe, fitted with 30″ spindle $^{7}/_{8}$ diameter suitable for belt drive without stand,
1 Doz. brass wire scratch brushes.

Price:

Lump sum price of the plant specified as above, packed where necessary and delivered F. O. R. Karachi... ... Rs. 14,955

Training.

Though the actual coating of the articles is automatic there is much to be learned in electroplating especially

where every kind of plating is required. The plater must possess some technical knowledge of chemistry, electricity and metallurgy,if possible. The following institutes impart training in the art:—

Maharaja Cossimbazar's Polytechnic Institute, Bagh Bazar, Calcutta.
Central Polytechnic Institute, Lashkar, Gwalior.
Govt. Trades School, Trichur.
Govt. Technical School, Lahore.
Govt. Metal Working Institute, Sialkote.
Govt. Metal Working School, Aligarh.
The course is of two years duration everywhere.

Books.

Blum W.—Principles of Electroplating and Electroforming. ... Sh. 27 0
Bonney S. R.—Chemical Colouring of metals and allied processes ... „ 10 0
Bonney G. E.—Electroplator.s Handbook (Pitman).
Canning— Electroplater
Cogshall K. M.—The Modern Electroplater ... „ 8 6
Denny C. W.—The Electric D eposition of Copper
Field S.—Electroplating .. „ 5 0
Hughes W. E—Modern Electroplating ... „ 7 6
Philip A.—Electroplating and Electroreforming of Metals ... „ 15 0
The Electrical Educater
Turner T. H.— Metal Spraying ... „ 15 0
Urquhart C. E—Electroplating ... „ 76 0
Walt A.—Electroplating ... „ 5 0

Journals.

Hardware Trade Journal, London E. C. 4
Industry, Calcutta.
Metal Industry, London W. C. 2.
Metal World, London E. C. 3.

Hosiery.

Hosiery in an industry closely allied to weaving. The textures used in the manufacture of either are the same and they serve a common object. Hosiery products are considered no longer a luxury. They are considered amongst the apparel requisites of man today. In India, besides upper classes, the middle classes of urban population have taken extensively to the use of cotton and wool hosiery. Even the servants of the upper classes wear socks, mufflers, pullovers, and bunians, now-a-days. Socks and underwears form an important part of the stock in the shops of all the drapers and general merchants, in every town. India imported hosiery worth Rs. 54,82,000 in 1931-32 out of which woollen hosiery is worth Rs. 6,69,000 and cotton hosiery of Rs. 48,13,000. Japan, China, France, America and United Kingdom are the chief countries from where hosiery articles are being imported. Of all these, Japan goods are cheaper though a bit inferior in quality and Japan is ousting other makes from Indian market on account of its being a sister Asiatic country having the sympathies of Indians. Of late many hosiery factories have been started in this country, besides there being thousands of individual enterprises in this country. And the progress and achievements made by Indian companies are marvellous though recent Japan competition is menancing and requires inmedate protection by State.

Excellent patterns of socks, stockings, mufflers, sweaters, jerseys, pullovers and bunians have been introduced in the market of Indian made in all fabrics, cotton, silk, wool, artificial silk etc.

In Punjab many hosiery factories are doing excellently and there are few who are not brisk with their business.

Mr. S. N. G. Ray says:—

The term *Hosiery* comprises many articles and specifies generally those goods which are knitted out of the special type of elastic yarn known as *Hosiery yarn.* Generally speaking we understand Banians, Underwears, Knickers, Jumpers, Sports uniforms, Stockings and hoses, both of woolen and cotton hosiery yarn by the term *Hosiery goods.*

In this article we will deal with the production of cotton banians and stockings, which constitute by far the largest items among the various hosiery goods in use in the country.

The following figures will show the yearly drain of money from this country in the shape of import of hosiery goods:—

Cotton Hosiery Imports

	1927	1928	1929
	(Value in Rupees).		
Stockings & Socks	1,56,851	1,47,799	1.60,660
Underwears	11,28,267	10,44,655	8,78,097
Other sorts	23,857	9,136	56,861

Cotton Hosiery—Our Suppliers.

We import mostly from Japan as will be found from the following figures:

	1926-27	1927-28	1928-29
	(Value in Rupees).		
Japan	1,17,66,316	1,13,53,866	1,25,19,313
U. K.	3,12,180	1,77,768	1,16,422
U. S. A.	5,43,746	3,38,387	2,98,116
Other Countries	20,89,691	18,93,459	15,09,761

It will be seen from the above figures what position Japan holds among our suppliers of hosiery goods. In

one month in 1929 (April) she sent about Rs. 9 lakhs worth of commodities which no other single country had been able to sell in the Indian markets even throughout the 12 months of 1928-29.

The above figures clearly point out the vast field that is lying before our industrialists in this line. Ahmedabad and Bengal are now vying with each other in the production of hosiery goods but still there is field, and with quality production with most up-to-date machinery having high and efflcient performance, there is no reason why we should not be able to oust the whole of foreign competitors successfully'

Difficulty About Yarns

The greatest difficulty which meets an Indian manufacturer is the quality of Indian hosiery yarn. As with most of our cotton mills, the production of hosiery yarn is only a subsidiary line, as enough attention has not been paid to the production of a perfect yarn. Most of the yarns produced are uneven, non-elastic and the spinning not being ideal tends to be fibruous, which causes lower output of the Bobbin winding Machine as also of the Hosiery Machine itself due to breaking of the yarn now and then. Inspite of these, the present yarns, especially of the Dhakeswari Cotton Mills, Bengal Luxmi Cotton Mills, Kesoram Cotton Mills, Luxmi Cotton Mills etc. can be used with profit.

In an article on the Hosiery Industry the first place must go to Circular Knitting Machine, which produce banians underwears, jerseys, pull-overs, etc. In producing these goods it is needless to say that all patterns and all sizes of goods are not possible to turn out from one single machine. Further no single machine can turn out a complete shirt or a banian. The size of the produced goods depends mainly on the size of the machine, and the fine or coarse texture,

on the number of needles used in the machine. The knitting machine itself turns out a circular or tubular piece of knitted cloth, like a loom. This piece of cloth has to be cut to sizes and made into required banian or under-shirt or the like. To produce a complete shirt, the following machines are necessary besides the Knitting Machine: Overlock Sewing Machine, Chain-Stitching Machine, Button-hole Making Machine and a Rib Top Machine. The Overlock Sewing Machine and the Chain-Stitching Machine are used to stitch the different pieces together as also for stitching the rims. Ordinary sewing machines are unsuitable for this purpose as elastic stitches are necessary which are not possible with them. The Rib Top Machine is used to make the ribbed arm-pieces which are separately made and then stitched to the main body by the Overlock Sewing Machine. A Rib Top Machine is capable of producing ribs sufficient to feed the total output of at least 5 knitting machines. A Button-hole Making Machine will cut and stitch about 60-80 complete button-holes per minute depending on the capacity of the machine. So at the outset only one of each of the Rib Top, the Overlock Sewing, the Chain-stitcher and the Button-hole Making Machine are necessary. Besides these one medium-sized Bobbin-winder to wind the yarn from hanks to bobbins, several irons, wooden patterns and a small screw press are also necessary. A Calendering Machine becomes a necessity if high class finished goods are to be produced.

Generally the knitted fabric of a 16″ Circular Knitting Machine can be treated to produce 34, 36 and 38 sizes of banians; 14″ to produce 28, 30 and 32 sizes and 12″ to produce 22, 24 and 26 sizes and so on.

As these 9 sizes of banians are always on demand, a medium sized factory should have all these 3 different

machines and the following estimate may be taken as a guide.

Estimate For a Medium-sized Factory.

One G. F. Grosser's Circular Knitting Machine, model RLA—Diameter 16″	... Rs.	2,800	0
One as above but having 14″ Diameter	... „	2,700	0
One as above but having 12″ Diameter	... „	2,600	0
One Grosser's Rib-top Machine Model RR. 3 3/4″ for Rib-tops, Legs, Sleeves, Caps, &c.	... „	850	0
One Overlock Sewing Machine	... „	550	0
One Chain Stitching Machine	.. „	125	0
One Grosser's Winding Machine Model U 1	... „	430	0
One Mansfeld's Screw Press Model B W 1	... „	160	0
Two country-made Irons	... „	8	0
Wooden Patterns each	... „	1	4

Excepting the Calendar Machine the above estimate is complete for a medium scale factory for "banians" and undershirts, &c. The output of the knitting machine depends on the quality of thread used on the winding of the yarn on the bobbins. Generally 8-9 dozens of banians can be turned out from each of the knitting machines per day of 8 hours ; so with 3 machines 24-27 dozen can be fairly turned out. The average consumption of yarn is about 3 lbs. per dozen banians depending on the quality of the yarn used.

The Expenses.

In calculating the expenses, the following items have to be recognised *viz.*, Establishment Charge, House rent, Breakage of needles (say Rs. 15 a month), Power, Oil, Grease, &c., Depreciation (at 10%), Cost of yarn, Cost of poplin and longcloth for lining, &c., Buttons, Packing and contingency charges. In the income side, of course, it is from sale of the produced goods alone.

Flat Knitting Machine.

There are flat knitting machines, too, for turning out knitted fabric. But their output is rather small in comparison with the circular knitting machines.

Making of Socks.

It is profitable to instal two or three automatic circular sock making machines with horizontal to stripe leg and foot of hose. Grosser's Automatic Seamless Hosiery machine, Model R M 5 is ideal for this purpose. Like circular knitting machines one size of sock making machine produces about 5 dozen pairs of complete hose per day. Except for the rib this machine produces complete sock. The rib is made in the Rib Top Machine separately and then is transferred on the sock making machine. The transferring of the 'cups' containing the rib requires some training and young boys can learn the job in a very short time.

In case, when sock making alone is desired, two automatic sock-making machines of different sizes should be taken as also a Rib Top machine, one Linking Machine to link the open space near the toe, one small Bobbin Winder, and Patterns and Irons.

Estimate For a Sock Making Factory.

The following is a rough estimate for a plant equipped to produce 5 doz. pairs of gent's socks per day or 130 doz. pair per month of 26 days.—

Block account.

		Rs.	As.
1	Grosser's Automatic Sock Making Machine 14 needles per inch 8 feeder ; size of Cylinder $3^1/_2$% ...	1,600	0
1	Rib-top machine ...	850	0
1	Linking machine ...	600	0
1	Bobbin Winder ...	430	0

		Rs.	A.
Brought Forward		3,480	0
1 Kerosene Oil Engine	...	490	0
Patterns & Irons	...	100	0
		4,070	0
Monthly expenses.			
Cost of yarn @ 10 oz. per doz. @ Rs. 2-4-0 a lb., say,	...	183	0
Cost of dyeing	...	30	0
Packing charges	...	15	0
Wages	...	120	0
Power & Breakage of needles, &c.	...	25	0
Overhead expenses	..	50	0
		423	0
Income per month.			
Price of 130 doz. pairs of socks, say, at Rs. 4-8-0 per doz. pair	..	585	0
Less Expenses	..	422	0
Profit per month	...	162	0

Power.

The consumption of power by hosiery machines is very small. Where electricity is available it is better to have electric motor, otherwise a kerosene oil engine or a crude oil Diesel Engine of cold-starting type is to be used.

Hand Soc Making.

Where capital is meagre or it is desired to run the business on co-operative basis, the hand sock making machines come in. They are very simple ; girls, boys, widows can easily work them after training of a couple of days.

Hand sock making machine can be had with or without rib-dial and are made with or without design wheel. Machines with rib-dial attachment will produce socks complete with ribs. When horizontal stripes are desired design wheel should be provided for. If several machines are installed, it is better to take machines without rib-dial and a separate rib machine should be purchased to feed the sock machines with ribs. Generally one Rib-top machine will feed about 5 sock machines.

If it is intended to do the business on home industry scale, it is better to take one Hand Sock Making Machine $3^{3}/_{4}''$ diameter with rib-dial attachment. This machine will produce socks of adult size (9, $9^{1}/_{2}$, 10 and $10^{1}/_{2}$ market sizes) by using wooden patterns. The following estimate may be taken as a guide:—

Block account.

		Rs.	As.
1 Grosser's Hand Sock Making Machine with Rib-dial attachment $3^{3}/_{4}''$ Diameter	...	160	0
1 Hand Winder	..	100	0
Wooden Patterns	...	25	0
Irons	...	5	0
		290	0

Expenditure per day.

		Rs.	As.
Yarn 2 lbs.	...	1	4
Dyeing	...	0	4
Sewing	...	0	4
Packing	...	0	4
		2	0
Breakage of needles	...	0	2

		Rs.	As
Miscellaneous	...	0	2
		2	4
Selling commission, &c.	..	0	6
		2	10
Income per day.			
2 doz. pair socks @ Rs. 2 doz.	..	4	0
Less Expenses	.	2	10
Nett daily income	...	1	6
Nett monthly income	...	41	4

In the above estimate we have not accounted for the wage of the operator as it will be run by an inmate of the house.

The above estimate, though rough, can be relied on as a guide.

WOOLEN HOSIERY.

The following estimates have been submitted to us by an expert for working hosiery factory for woolen pullovers, sweaters, mufflers, etc., to be started with a capital ranging from Rs. 5,000 to Rs. 20,000.

A scheme for a Capitalist investing Rs. 20,000.

4 doz. pullovers		Rs.	As.
One Rashel Machine	...	3,100	0
One Winder	...	500	0
One Warping Machine	...	150	0
One Overlork	...	650	0
Fitting and Accessories	...	300	0
Engine or Dyanamo	...	300	0
		5,000	0

		Rs.	As.
Yarn about 40 lbs.	per day ...	100	0
Wages	„ „ ...	3	8
Winding charges 0-0-6 per lb.	...	1	4
Dyeing „ 0-4-0	...	10	0
Tailoring and finishing Rs. 2 per doz....		8	0
Labelling and Packing Rs. 1-0-0	...	4	0
Needles, depreciation and oiling 0-8-0	per day ...	2	0
Power Expenses	„ „ ...	4	12
	...	133	8
Sale price per doz. Rs. 54-0-0	...	216	0
Cost	per day ...	133	8
Saving	„ „ ...	82	8
Overhead charges 10%	...	8	4
Net profit daily	...	74	4
„ „ for a month of 25 days	...	1,856	0

Deducting Rs. 5,000 the cost of machinery out of Rs. 20,000 we have a balance of Rs. 15,000 which can serve for months.

Therefore yearly profit	7,545	0

SCHEME FOR A CAPITALIST INVESTING Rs. 10,000.

1. For producing 4 doz. Pullovers	Rs.	As.
One ordinary Jaquard Machine country made per day ...	300	0
One full Jaquard circular made ...	650	0
One overlock three thread (German) ..	650	0
	1,600	0

	Rs.	As.
Brought Forward ...	1,600	0
One rib machine " " ...	100	0
One tape machine " " ...	200	0
Fitting and accessories " " ...	300	0
	2,2000	0
Yarns about 40 lbs. per day ...	65	0
Wages " " ...	3	0
Winding charge per lb. 0-0-6 ...	1	4
Dyeing charges " lb 0-4-0 ...	10	0
Tailoring and finishing Rs. 2-0-0 per doz. ...	8	0
Labelling and Packing Rs. 1-0-0 per doz. ...	4	0
Needles, depreciation oiling 0-8-0 per doz. ...	2	0
	93	4
Sale price net Rs. 30 per doz. ...	120	0
Cost per day ...	93	4
Saving per day ...	26	12
Overhead charges 10% ...	2	12
Net profit per day ...	24	0
Or a monthly profit of 25 days ...	600	0

Deductin Rs. 2,200 the cost of machinery out of Rs. 10,000, we have a balance of Rs. 7,800 i. e. running expenditure which can serve for a period of 5 months nearly yielding a net profit of Rs. 3,000 for that period i.e. for a year.

SCHEME FOR A CAPITALIST INVESTING Rs. 5,000.

For producing 2 doz. pullovers	Rs.	As.	P.
One full Jaquard circular country made...	650	0	0
One overlock three thread (German) ...	650	0	0
	1,300	0	0

		Rs.	As.	P.
Brought Forward	...	1,300	0	0
One rib machine	...	100	0	0
One Tape machine	...	200	0	0
Fitting and accessories	...	300	0	0
		1,900	0	0
Yarn about 20 lbs. per day	...	32	0	0
Wages " "	...	1	12	0
Winding charges 0-1-6 per lb.	...		10	0
Dyeing " 0-4-0 per lb.	...	5	0	0
Tailoring and finishing Rs. 2 per doz.	...	4	0	0
Labelling and Packing Re. 1 per doz.	...	2	0	0
Needles, depreciation and oiling Rs. 0-8-0 per doz.	...	1	0	0
		46	6	0
Sale price nett Rs 30 per doz.	...	60	0	0
Cost per day	...	46	6	0
Saving per day	...	13	10	0
Over head charges 10%	...	1	5	9
Nett Profit daily	...	12	4	3
" " of one month of 25 days	...	806	10	3

Deducting Rs. 1,900 the cost of machinery out of Rs. 5,000, we have a balance of Rs. 3,100 which can serve for a period of 4 months yielding Rs. 1,200 only for that period i. e. for a year.

Statement of accounts of production and sale. (Power section) per day of 10 hours.

Machinery.	Production.	Cost price. Rs.	As.	Sale price. Rs.	As.		Rs.	A.
3 Rascheals.	9 doz Pullovers	337	8	540	0	@	50	0
1 Jackard Rascheal	12 doz Pullovers	335	8	576	0	@	48	0
1 Jackard "Fine"	4 Jumpers.	83	4	144	0	@	36	0

		Rs.	As.	Rs.	As.		Rs.	A.
1 18" Full Jackard Circular.	2 doz Pullovers	71	8	108	0	@	54	0
1 Circular Loop-Wheel.	1 1/2 doz Lady Coats.	104	14	144	0	@	96	0
1 16" Under wear Circular Machine	5 doz Under-wears.	99	3	120	0	@	24	0
2 Circular Machines for ordinary Jackard Pullovers	3 doz Pullovers	59	6	90	0	@	30	0
1 Circular Machine for Mufflers.	4 doz Mufflers	60	12	84	0	@	21	0
1 Circular Machine for Balclavo Caps.	6 doz Caps.	56	2	81	0	@	13	8
2 Circular Machines for Children Hard-Wear Jerseys.	6 doz Jerseys.	46	10	54	0	@	9	0
2 Automatic Socks Circular Machines	5 doz Socks.	22	2	30	0	@	6	0

General cost:—(per day).

1 Engine Driver	... Rs.	1	8	
Oils	... „	2	0	
Lubricants	... „	0	8	
Depreciation of Engine, Wiring, Mills Machines, Repairs etc.	... „	3	0	
1 Chief Machineman	... „	3	0	
1 Oil Man, 1 Cleaner	... „	1	0	Total Rs. 11

Total	Rs.	1287	13	1971	0

		Rs.	As.
5% commisssion on sales to dealers	...	98	0
Less 5% Agents commission	...	93	10
Nett sale price	...	1778	14
Cost	...	1287	13
Profit	...	491	1
Similarly profit fron Hand section	...	47	0
Total profit	...	538	0
Over head charges 20%	...	107	9

		Rs.	A.
Nett profit	per day ...	433	8
Nett profit for 25 days in a month	...	10762	8
Yearly Nett income	...	129150	0
Managing Agency remuneration at about 12 1/2 °/₀	...	16150	0
Nett Saving	...	113000	0
Reserve fund	...	13000	0
Nett to be declared as dividend	...	100000	0

Paid up Capital Rs. 250000 0

therefore the dividend declared comes to 40%.

Training Institutes.

Cottage Industries, Gulzaribagh (B. & O).

Government Central Weaving Institute, Benares.

Government Hosiery Institute, Ludhiana.

Lalkurti Hosiery School, Meerut.

A practical training can be arranged at any of the firms doing hosiery manufacture work, as apprentice.

Hosiery Factories.

Andhra Hosiery Mills, Bezwada.

Bose Belliaghata Hosiery Factory Ltd., Calcutta.

Cawnpore Woollen Mills, Cawnpore.

Coronation Woollen and Cotton Hosiery Factory, Parel Bombay.

Gujrat Hosiery Factory, Ahmedabad.

Oudh Hosiery Works Ltd., Lucknow.

Poineer Hosiery Factory, Ferozepur.

Swadeshi Manufacturing Syndicate, Ludhiana.

Tilak Hosiery Factory, Lahore.

Machinery Dealers.

Asiatic Knitting Commerial Corporation, P. B. No. 418, Bombay. (Knitter Rs. 325, Bunian Machine Rs. 2,600 and 4,700.)

Automatic Knitting Machine Co., Ltd., 67, Southwork Street, London S. C.
B. Hague & Co., Ltd., Nottingham.
Canon & Stokes, Ltd., Leicester.
Dhrutt & Co., 24 Srimanto Dass Lane, Bow Bazar, Calcutta.
G. F. Grosser, Markersdorf 13, District, Leipzig.
H. Brinton and Co., Philadelphia, U. S. A.
Harrison Patent Knitting Machine Co., Ltd., 48, Upper Brook St, Manchester.
Meller, Bromley & Co., Ltd., Leicester.

Books.

Chamberlain J.—Manufacture of Knitted Footwear.
Comparitive Yarn Tables.
Davis, W.—Hosiery Manufacture (Pitman) 7 sh. 6 d.
Davis, W.—A Text Book of Hosiery.
Felkin, W.—History of Machine Wrought Hosiery and Lace Industries.
Gordons Cost Finding in Knitting Mills.
Hosiery Yarns and Fabrics.
Quilter J. H.—Counts and Gauges.
Rowlett—Technology of Frame Work Knitting.

Journals.

Hosiery Trade Journal, Leicester, England.
Indian Textile Journal, Bombay.

Laundry.

Next to food and shelter, clothing is the greatest need with a human being. The problem of clothing is divided into two sections:—manufacturing and renewal. Washing is another name for renewal of cloth or renovation of fabrics by cleaning methods. Undoubtedly, therefore, laundering is an industry of greatest service to mankind and is very big to engage millions of people in its trades.

In India washing of clothes is being handled by washermen or *dhobies* since yore, though the housewives do a great deal of domestic washing work. These *dhobies* are illiterate, poor and live on hand to mouth earnings. In advanced countries people, as do laundry work by old methods, are being replaced by steam and power laundry establishments and each establishment can engage over hundreds of men and women. Laundering work is being carried on scientific lines that saves the cloth from early decay and which is more hygienic and sanitary for wearing. In these laundries washing, rinsing, drying, starching and clothing, all processes are handled by means of various types of machineries. From tie and bow to a tent, all can be washed in a laundry. The science has developed and progressed to such an extent that there have sprang laundries specializing in certain types of clothes alone.

The working a laundry is divided into following processes:—

1. *Collecting*.—Clothes are collected from place to place, in a van or a motor lorry. In India these are received at the laundry office generally.

2. *Receiving.*—Where clothes are received from the collectors, if not received at the premises of the laundry.

3. *Checking, Marking and Sorting.*—Here articles are checked with the customers lists and sorted into groups according to the treatment required. They are marked where necessary and noted where damaged. Warm, silk, cotton, dyed clothes are separated to undergo various treatments.

4. *Washing.*—In steam laundries, mechanical rotary washers, tended by men and boys, are used consisting of a water tight container of metal with a revolving metal cage within, in which clothes are brought into contact with water and cleaning materials in the container. Steam, hot water 'blue' are used in the washing process. They are rinsed in the successfully decreasing warm water.

5. *Drying.*—Hydro extractor consisting of a metal bowl with an inner basket of metal, which spins very rapidly and drives out the moisture by certrifugal force, are used in drying clothes. They are opened out by 'Tumbler' or by hand. They are further dried in steam heated apartments

6. *Starching.*—Where necessary starching is applied to clothes. Special devices are used for partly starched articles such as shirts, whereas starching boxes are used for others.

7. *Drying.*—These are dried generally in a drying room or by hydro-extractors.

8. *Ironing.*—Then they are damped for being ironed. Starched articles are ironed damped. This ironing is done by calendar and many by mechanically driven gas-heated irons or by a steam press.

9. Then the clothes are examined, sorted, and checked against customers lists, missing clothes traced and then packed and delivered.

10. After this they are again sorted and placed up for delivery.

Investment.

Indo-German Products Corporation, Opposite G. P. O. Bombay, can instal a plant of steam laundry anywhere in India with a capital of Rs. 10,000. A capital of Rs. 5,000 is required, besides, as working capital. For complete estimate the Corporation may be written to.

Estimate of a Laundry Plant capable of treating 2,000 shirts per day of ten hours submitted by M/s. L. T. Pinto & Sons, Lahore.

		£s.	
Modern Rotary Washing Machine	...	92	0
Multi-Jet Washing Machine	..	135	0
Galvanised W. I. Soap and Soda Dissolver	...	12	0
Laundry Type Self-Balancing Hydro Extractor	...	80	0
Set of Pitch Pine Wash Troughs	...	15	0
Continuous Drying Room	...	270	0
Super G. W. Decoudun Ironing Machine	...	410	0
Steam Heated Garment Presses	...	214	0
Cordless Type Electric Hand Irons	...	24	0
Total		£s. 1252	0

Prices:—The prices quoted in this tender are F. O. B. London and net and no reduction is possible. Electric motors, shaftings piping, wood work etc. would cost Rs. 300 extra.

Qualifications.

This business is specially suited to graduates in Industrial Chemistry or Textiles. But a higher general education, a knowledge of Chemistry and a grit in organisation of business are important factors for success in this

trade. A practical experience in such a laundry is most essential for a successful venture. A knowledge of mechanism is equally necessary.

Side Lines.

What has been said of laundry trade, applies equally well in establishment for dry cleaning, both of which can be run side by side. Dyeing and calico printing are other industries that can be run as allied industries.

Training Institutions.

In India there are no institutions imparting a training in laundering and work can be learnt as an apprentice in some steam laundry.

In England, National Federation of London has arranged evening courses in the Science. Drexel Institute, Philadelphia, U. S. A., Teachers College, Columbia University, U. S. A. Borough Polytechnic Institute, Borough Road, London, S. E. I. and Municipal Technical School, Bolton, England, also impart training in laundering.

Work is semi-skilled and requires more of dexterity and commonsense than mental superiority.

Steam Laundries.

Angus Steam Laundry, Bhadreswao, Hooghly ; Diamond Jubilee Washing Co., Bombay ; Spencer's Steam Laundry, Mount Road, Madras; Taj Mahal Hotel Laundry, Bombay.

Machinery Dealers.

American Laundry Machinery Co., Cincinnati, Ohio.
Boss Washing Machine Co., Cincinnati, Ohio.
Chicago Drier Co., Chicago, U. S. A.
Domestic Laundry Equipment Corporation, New York City.
Lovel Manufacturing Co., Erie, Penn, U. S. A.

W. Somerscales & Sons, Ltd., Conly Lane Works, Keighley, England.

Books.

Balderston, L. R.—Laundering.
Brault, W. T.—Dry Cleaning, Scouring and Garment Dyeing.
Chambers, M. D.—Guide to Laundering Work.
Hansbrand, E.—Drying by means of air and steam.
Harvey, A.—Laundry Chemistry.
Marsh, E. L.—Laundry Work.
Rankin, M. C.—Science of Laundry Work.
Woolman, M. S.—Clothing, choice, care and cost.

Journals.

Laundry Journal, London, N. W. 6.
Laundry Record, London, W. C. 2.
National Laundry Journal, Chicago, U. S. A.
Power Laundry, London, S. W. 1.

Leather Industries.

India exported hides and skin worth Rs. 11,74,000,00. during year 1930-31 and worth Rs. 8,92,000,00 during year 1931-32. The average declared value of raw hides and skins was 0-7-9 per lb. during year 1931-32. Most important of hides were these of cows, buffalo, goats, sheep etc. Out of these raw hides and skins valued at Rs. 3,65,000,00 and tanned and dressed hides and skins valued at Rs. 5,26,000,00. Germany, U. S. A., Italy and England are the main purchasers of Indian raw hides and skins. The share of provinces in export of raw skins was Bengal (52%), Bombay (72%), Sindh (28%) and Madras (8%) in export of tanned skins. Madras was the leading (91%) country.

During 1931-32 India imported boots and shoes worth Rs. 64,93,000 and belting for machinery worth Rs. 50,11,000.

All these figures go to show the extent up to which leather industries can be developed and extended in the country and can afford employment to millions of Indians.

In the words of Principal of Bengal Tanning Institute:—

Tanning and manufacture of leather goods are classed under Leather Industries. They represent a very useful and important group of modern industrial activities. India offers ample opportunities for their development. Hides, skins and tanning materials are available in abundance, and the demand for leather and leather articles is increasing from year to year as the country is advancing on modern lines.

In order to take advantage of the opportunities India must learn a lot about these industries. From time immemorial the business of making leather and leather goods

in India has been left to Charmakars, who, being poor and illiterate, have not been able to keep pace with the progress made in Europe and America. This is the principal reason why the tanning industry has not hitherto been able to make a headway in this country.

All industries are tending to be more and more scientific and leather industries are no exception. It is now recognised that tanning is based on science in which a great deal of chemical reactions, mechanical operations and economic factors are involved. The manufacture of leather goods is effected by complicated machinery. A thorough grasp of the scientific principles, skill for operating the machinery, finance for installing plants, and capacity for industrial organisation are essential to run these industries with such efficiency as may enable them to hold their own against modern competition. The task is obviously beyond the capacity of Charmakars in their present economic condition.

For the attainment of this efficiency it is necessary that men of education and wealth should pursue these industries and the prejudice entertained towards them in the past should be cast off. The scope and magnitude of the industries should make them worthy of pursuit of the intelligentsia of the country.

The industries cover a large ground, comprising as they do, (1) the production of raw hides and skins ; (2) their collection, caring and preservation ; (3) their marketing ; (4) tanning of various descriptions of leather ; (5) selling and distribution of leather ; (6) manufacture of boots, shoes and various other leather goods ; (7) selling and distribution of boots, shoes and other leather goods in India and overseas ; (8) cultivation and collection of various tanning materials ; (9) manufacture of tanning extracts of other preparations required in leather industries ; (10) training of tanners and skilled workmen and researches for the

improvement of raw materials and finished leather and leather goods ; (11) manufacture of tanning and leather goods machinery and their selling ; (12) making designs of tanneries and leather goods factories, etc.

In all industrially developed countries each of these branches offers employment to a large number of people drawn from different sections of the community. Flayers, curers, raw hide and skin merchants and factors, tanners, skilled tannery operatives, highly educated leather chemists and research workers, manufacturers of boots and shoes and other goods, leather and leather goods factors, salesmen, commercial travellers, manufacturers of tanning extracts, speciality preparations and grinderies, leather trade engineers, teachers, administrators, financiers, and many others are component parts of this big industry. It offers careers to the high and the low, to the educated and the uneducated, to the rich and the poor, to the brain worker and the manual operatives.

Very few of these potential avenues of employment in leather industries have been exploited by the people of India. True, there is a large trade in raw hides and skins in India and that the annual export of these materials amount to about six crores of rupees in value. It is also true that the business done in finished leather and leather goods in Calcutta amounts annually to about four crores of rupees. But the share of Indian in this colossal business is very small ; and what little there is, is confined merely to the collection and curing and transport of a portion of the raw hides and skins to Calcutta. The more intelligent and remunerative parts of the business which demand superior brains, business ability and finance are in the hands of non-Bengalis. The income of those that are at present doing these higher works of the trade is quite decent and is such as should satisfy all reasonable ambition.

No longer a prejudice exists in Hindus in adopting this work and the successful and bright lead given by the Bhalla Family and like has given a social status to this industry. But unfortunately, except in the case of *chamars* or *mochies*, no attempt has been made by the educated youths to enter the manufacturing lines of leather industries. The trade is already in their hands. But until the manufacture also is taken up by them, as independent trades, it is not possible that they may be much benefitted. There are various branches of leather industries and every branch offers large field, especially when cloth and metal goods are even manufactured of leather such as bags, suit cases, gloves, belts etc.

Boots & Shoe Making.

The shoe is one of the most important items in our dressing outfit and is by no means a recent invention. We know what curious shapes of shoes were worn in former times, and we are also aware that the shoe, like the rest of our clothing, has always been subject to the whims of fashion. But the role that the shape plays at the present time would be unthinkable, if we were not in possession of all sorts of machines that enable us on the one hand, to manufacture shoes in any necessary quantity and, on the other, to produce articles of high quality that satisfy the innumerable and constantly changing demands of fickle fashion.

The many-sidedness of the present day shoe-manufacture is due primarily to the fact that the shoes for men differ fundamentally from those for women in shape and external appearance. Though the modification possible in women's shoes, with regard to shape are very much more numerous than in men's yet the attitude of men towards the decrease of fashion has brought about a great

deal of variety in his footwear. If we also remember that, apart from children's shoes, there are also shoes for special purposes and that every kind of shoe must be obtainable in a number of different sizes, we shall be able to understand why the demands for shoe making machines are quite different from those used in the manufacture of any other mass-product.

Boot and shoe making is the biggest of leather industries and it is pleasing to note that today India is meeting herself practically the whole of its demand for boots, and shoes by Indians. Small factories for boots, shoes, sleepers, half sleepers can be run by individuals with little capital and there is a great chance for individual craft, as a boot made by an individual to order is considered more durable and more convenient. In Calcutta, Agra, and Cawnpore, sleepers are made by various *mochies*, and to order, by certain firms, who collect them and market them with their own impressions, on the sleepers, as manufacturers. There is a chance in such trades for many more.

Boots and shoes are nowadays made both by hand entirely as a cottage industry and by means of machinery as a factory industry and both trades are very paying as crafts.

In either method, they pass through a number of common operations. The difference being that in the hand process one man completes the entire shoe by performing all the operations himself, while in the machine process the work is distributed, each operation being done mostly by machine, by different sets of men.

The entire process of shoe-making may be divided into seven distinct operations:—

(1) Pattern cutting.

(2) Clicking.

(3) Closing.
(4) Bottom stock cutting.
(5) Lasting.
(6) Attaching.
(7) Finishing.

Instructions in each of these subjects are given by lectures, demonstrations and practical work at various tanning and leather Institutes in India and the training is expected to make the students competent to start independent business in boot, shoe and leather goods making even with modest capital.

Saddlery is the next greatest item of the industry. It is mainly in demand by the Military Department for its Cavalry. And though the Government Harness and Saddlery Factory at Cawnpore meets much of the demand, yet the Government has to place orders with Government Contractors for meeting extra demand from time to time. Besides that there is a vast demand by states, *reises* and for tonga walas etc. It offers opportunities of earning livilihood to many.

Ornamental Leather Work.

Ornamental leather work is a skilled industry, but can be learnt with some difficulty and requires very simple and cheap tools to work with. As a decorative medium, leather has great possibilities and offers chances of employment to many during spare hours. Leather workers should always see and work out best modern popular designs in leather and introduce them anew every day in the market. Ornament when it arises spontaneously is likely to have significance and when it lacks this, is apt, except in the hand of the superlative craftsmen, to appear rather as a blemish ; wherein a plain article well made, of good proportion and serving a useful purpose, supplies a

real need and justifies the craftsman. The kinds of decorative work are:—

Blind tooling, gold tooling, low relief or modelled leather, repousse or embossing, lncised leather work, applique work, Inlay work, suede or soft leather work etc.

Articles made and in demand are:—

Handbags, portfolios, blotters, calendars, book covers, comb cases, photo frames, screens, music cases, purses, pen wipers, writing pads and cases, card cases, belts, book markers, hats, bags, gloves, etc.

Leather required is soft skins such as velvet, suede-chamois, white doe, velvet suede, antelope, French kid, tan cape, calf skin, or cowhide.

Equipment required are an incising knife, a tracing tool, a modelling tool, two punches, a ruler, a mallet, a sponge, a sixway punch, a knife, a press stud tool, a thonging tool, a stitch spacer, 1 pair of scissors etc. All can be had for a few rupees from any high class ironmonger or edge tool dealer.

Institutio

The following institutes impart a trainning in leather industries in machinery:—

H. B. Technological Institute, Cawnpore (2 years for B. Sc in leather chemistry).

Government Training Institute, Calcutta. (2 years in training for matrics. One year in boot and shoe making for literate boys.)

Government Leather Trades Institute, Madras. (2 years course open to matrics).

Government Leather Working School, Cawnpore and Meerut.

Leather Working School, Dyalbagh, Agra. (3 years) course.

Besides a practical training can be had at any of the leather working factories in India.

Leather Goods Manufacturing Machinery Dealers.

British United Shoe Machinery Co., Liecester, England.
Dennis Martin & Co., 859 Summer Avenue, Newark N. Y.
Foulds & Sons, Hudson, Mass.
Koch & Co., g m b h, Wandsbek, Hamburg.
Max Fredrich & Co., Plagwiz, 32, Leipzig, (Leather Waste Machinery).
Miller August Nene Friedrichstr 40, Berlin.
Standard Engineering Co., Evington Volley Road, Liecester.
Whitley Machine Co., Winchester, Mass.

Leather Factories.

Allen Brothers & Co., Cawnpur.
Bengal Belting Works, Clive St., Calcutta.
Bengal Tanneries, Kidderpore, Calcutta.
Bhopal Shoe Factory, Bhopal.
Cawnpore Leather Works Co., Cawnpore.
Chrome Leather Co., Madras.
Delhi Embroided Shoes Co., Bertram St., Calcutta.
Dyalbagh Model Industries, Agra.
Emporium Steam Boot and Shoe Factory, Agra.
Eureka Belting Works, Howrah.
Gwalior Leather Works and Tanning Works, Gwalior.
Harn Otin & Co., Cornwallis St., Calcutta.
Indian Leather Industries, Diamond Harbour Road, Calcutta.

Madras Chrome Factory, Madras.

Mysore Tannery Ltd., Bangalore City.

National Tannery Co., Entally,Bengal.

North West Tannery Co., Cawnpore.

Swaraj Tannery, College St., Calcutta.

Western India Tannery Ltd., Hornby Road, Fort, Bombay.

Books.

Adcock, K. J.—Leather from the raw material to the finished product.

Edward, H. M.—Glove making.

Francis, L. C.—Art and Craft of Leather Work.

Golding, F. M.—Manufacture of Boots and shoes.

Harding, J. S.—Boot and Shoes Industry.

Leno, J. B.—Art of Boot and Shoe making.

Luckock, J. T.—Manufacture of Fancy Leather Goods.

Mochrie, E.—Leather Works with Suede and other soft leathers.

Monographs on Leather Working industries in India published by the various provincial Industries Department.

Plucket, F.—Boot and Shoe Manufacture.

Seeley—Staining, Colouring and Gilding.

Seaw, G. J.—Leather Craft.

Staite—Glove Making at Home.

Turner, H.—Artistic Leather Work.

Wylie—Decorative Leather Work.

Journals.

American Shoe-making, Boston, U. S. A.

Boot and Shoe Recorder, Boston, U. S. A.

Hide and Leather, Chicago. U. S. A.

Journal of the Federation of Boot Manufacturers, London W. C. 1.
Leather Trades Review, London, E. C. 4.
Leather World, London, S. E. 1.
Leather Goods, London E. C. 4.
Shoe and Leather Record, London E. C. 4.
Shoe Manufacturer's Monthly, Leicester, England.

Metallic Manufactures.

Metal forms the very basis on which the whole structure of world's industry stands. It is the biggest and most important industry of the world and engages the largest number of people in its various trades. That such an industry should occupy its deserved position in India, is self evident.

India was once particularly famous for its iron maunfactures. The renowned iron pillar near Delhi is one of the achievements of old industrial India. It cannot be turned out even by some of the largest factories of world today. The antiquity of India's knowledge of iron can be traced out from the collection of arms preserved by princes and in museums, from the hammered and perforated door panels in palaces, from the iron *thees*, from engraved iron pillars, from silver and gold damascened armours, swords, spears, caskets etc.

But Indian iron and steel industry suffered a great set back against foreign compitition and India imports to-day about thirty crores of rupees worth manufactured iron and steel. It is a pity that from materials for aeroplanes, ships, railway stocks, machinery, power engines down to pegs, pins, nails, bolts nibs, nuts and needles, India depends for its supply on foreign imports. There could not be a greater misfortune and a stronger proof of our helplessness and degradation. It is alleged that as the industry depends upon abundance of iron and coal mines and as, except in Behar and Orissa, they are not found, side by side, the iron industry is bound to work slow. But this holds no longer true in face of the amazing potentialities of water power

in which India abounds and India can now boast of its hydro-electric energy. Moreover the wonderful and amazing work done by the Tata Iron and Steel Company, Indian Iron and Steel Co., Tin Plate Company of India Ltd., show that India can, if she likes, save crores of rupees that is drained out of the country. India produces even today enough of pig iron. In 1931-32 iron and steel worth Rs. 1,49,26,000 was exported to other countries and other metals exported valued at Rs. 2,50,43,000. Iron produced in India during 1927 valued at Rs. 51,01,861. We refrain from discussing it at length as this is a large scale industry and out of the province for discussion in this book. What we concern with is the manufacture of iron and steel articles, from unwrought iron, produced in India or imported.

Total Imports of Iron and Steel goods during 1931-32.

Machinery and Mill Work	Rs.	10,92,34,000
Vehicles	„	4,48,47,000
Hardware	„	2,60,91,000
Cutlery	„	20,69,000
Building and Engineering materials	„	83,78,000
Instrument apparatus and appliances	„	3,69,20,000
Metals and ores	„	9,77,65,000
Total about	Rs.	32,50,00,000

So these form the most imported group among India's Imports and rank first amongst Imports of India.

Import of Iron and Steel (including pig iron and old iron and steel) was worth Rs. 6,32,00,000.

Hardware consisted of:—

Implements and tools	Rs.	35,14,000
Lamps and parts	„	35,65,000
Builders hardware	„	24,60,000

Agricultural Implements	Rs.	5,53,000
Enamelled hardware	„	15,04,000
Domestic hardware	„	8,22,000
Other sorts	„	1,36,73,000

Razor Blades.

Dr. J. L. Sarin Ph. D. writes:—

The manufacture of razor blades is easy, and inspite of the fact that the raw material (steel ribbon) shall have to be imported from Europe, it is considered that there will be a satisfactory return. A plant capable of producing 5,000 blades in 8 hours will cost about Rs. 5,000. For people who can invest larger sums it will be more profitable to instal an automatic plant.

Such a plant will produce from 30 to 50 thousand blades a day and will cost about Rs. 20,000. The smaller plant can easily be worked by locally trained labour but for the larger plant it may be necessary to employ a foreign expert for a short period. The manufacturers of this ma-machinery are always willing to send out their experts on reasonable terms.

The manufacture of the razor blades may be conducted either directly from steel ribbon, or from hardened raw blades. The plant required in the former case is more elaborate and costly, while in the latter it is much easier to manipulate and at the same time is cheaper in price. The machinery required in both cases, however, is practically the same except that the first three items in the list of the machines given below are to be eliminated when the manufacture is to be conducted from raw razor blades. The details of the machinery are following and the prices are marked against each in U. S. A.

1. Installation of the manufacture of Razor Blades.

Item. Capacity— 5,000 blades in 8 hours.	Price. U. S. A. $.
1 double—armed spindle press for cutting out the razor blades from steel ribbon	... 65.
1 guide— cut with 3 guiders	... 45.
1 special razor blades hardening furnace.	... 125.
1 scrubbing —drum	... 40.
1 special razor blades etching machine. (used for writing the names of the manufacturers etc. on the blades).	... 45.
2 grinding machines	... 100.
2 polishing machines	... 100.
2 finishing machines used for obtaining the last finishing of the blades	... 120.
Total	... 640.

Taking the rate of exchange to be on the normal at Rs. 4/- a dollar, the current price of this plant would be Rs. 2,560. All these prices are f. o. r. German Port of embarkation. Another Rs. 2,000 will be required for engine and fittings.

The use of the above machinery is easy and an ordinary trained blacksmith or mechanic can erect it and turn out good blades with short practice.

Automatic plant for the manufacture of razor blades is also available. To instal such a plant is only economical when the production of the blades is desired to be about 30 to 50 thousand a day. Complete price for such a plant would be somewhere near about Rs. 20,000.

The price of ribbon steel is about Rs. 148 per maund from which about thirty thousand blades of first class quality

can be manufactured. It is estimated that meeting all costs of manufacture a saving of about 80% can be effected.

Razors.

No special plant is required for the manufacture of razors. A good eccentric press with necessary dies, a lathe and an electro-plating and polishing equipment will be enough to produce ordinary types of safety razors.

Pins and Clips.

Industrial Chemist to Punjab Government writes:—

Both these articles of stationery are of very common use. There is not a single factory manufacturing them in the province. There is a large consumption of these articles both by Government departments and the public. A complete plant capable of producing 300 pins and about 200 clips per minute will cost about Rs. 18,000. If put up separately, the pin plant will cost. about Rs. 12,000 and the clip plant Rs. 6,000. Trained labour to work the plant is available in the province. It has been calculated that a return of nearly 10 to 15 per cent may be expected in the first year of working, but if a battery of such machines is installed, the return may be considerably increased. The raw material will at present have to be imported from outside but it is quite possible that it may soon be produced in the country as a result of the protection recently granted by Government to wire and wire nail industries.

For the manufacture of pins, the plant required consists of:

1. One automatic pin head and point making machine, capable of making 300 pins per minute ... ... Rs. 6,900

2. One tin quoting equipment for brass pins	Rs.	1,000
3. One drawing and polishing equipment, and	„	1,000
4. One automatic machine for sticking the pins into paper. (This may be left out and pins sold in boxes)	„	4.500

The above prices are F. O. B. American port.

The Machine No. 1 described above will make only one size of pin. As there are six standard sizes from $^{3}/_{4}$" to $1^{1}/_{4}$" lengths, it would be necessary to order one of each size. But to start with, only two or three sizes may be ordered.

The motive power, fixtures and buildings will cost extra and may cost about Rs. 10/- thousand. The Industry does not require much technical skill and knowledge and its mechanical side is easily comprehensible. It can be started with advantage.

Economics of the Industry.

One pound of brass wire gives about 5,000 pins of one inch length. The cost of 1 lb. of wire in Lahore is annas 8 per lb. Adding about 100% on account of manufacturing and other charges, the price of 5,000 pins works out to be Rs. 1/- or about annas 8 per thousand. The selling price of 1,000 pins in the Lahore market is about annas 5 to 6 per thousand. In case the pins are made from iron wire the cost can be cut down by another 20 per cent.

The following firms can supply the plant :—

1. The Baird Machine Company, Bridgefort Conn. Stratford Avenue, U. S. A.
2. Morton Brothers, Engineers, Round Green, Oldburg near Birmingham, England.

Manufacture of paper clips.

Like pins, the Manufacture of paper clips is purely a mechanical industry. There are probably about 30 different designs of paper clips in use. With one or two exceptions, a different design of machine is required for each clip and in some instances, the variation between the size of the smallest and that of the largest one does require different sizes of machines for the same design of clip to cover the range of sizes. The most common design of clip which is in use, is known as Gem's style and is commonly sold in three different sizes and in this particular instance it so happens that that the same size of machine is an efficient one to use for making any one of the three sizes. These machines can be made according to the requirement, that is according to the number of clips it is desired to turn out per minute. A machine for making 175 to 200 clips per operating minute would cost about Rs. 6,000/-. The battery of such machines can be attended by one man and if such a battery can be installed, the cost of manufacture can be considerably reduced.

One lb. of wire gives about 700 clips of $1^{1}/_{4}$" length. The price of 1 lb, of wire in Lahore is annas 2/9 per lb. Adding 50% for cost of manufacture, the price of 700 clips would come to about annas 4 or annas 5 per thousand. The current price of these clips in the local market is Rs. 1/4/0 to Rs. 1/8/0 per thousand.

Safety-pin Making.

Competition in the manufacture of the ordinary domestic safety pin has resulted in the evolution of several most ingenious machines, devised with the object of eliminating, as far as possible, the employment of manual labour, and so successful have been the inventors of these machines that

the price at which safety pins can be sold is only very slightly in excess of the cost of the materials they represent. The manufacturing costs have been reduced to such an extent by the use of automatic machinery, that the total cost of production amounts to less than 2 annas per gross of pins. This fact is all the more remarkable when it is borne in mind that a very high degree of accuracy has to be maintained, or the various processes will be put out of gear, and the pin will not act properly, while the demands of retailers are very exacting as to the finish and style in which the pins are offered.

There are, of course, several different types of safety-pins, and the one dealt with first is that in which a separate sheet metal cap is used to protect the point. The pins are made by one or other of the two processes, one of which requires two machines only, while in the other two operations performed by the second machine are separated and three machines are thus required. Small quantities of special pins are made largely by hand, but the appliances then used are comparatively simple, and not nearly so interesting as the automatic machines.

The preliminary operation to make safety pins of good quality is to straighten, cut off and point the wires. It is essential that the wires should all be exact to length, as otherwise the subsequent operations would be put out of gear, and it has been found that the necessary exactitude cannot be attained if the pins are pointed with the grinding wheel running away from the point. The grinding has therefore, to be done towards the point.

The wire is supplied in the form of ordinary coils, and is placed on a swift at the back of the machine. It is drawn through a straightener comprising a series of pegs in a rotating frame through which the wire is pulled by a pair

of feed rolls operated by a double-crank feed mechanism. Each stroke of either crank brings forward enough wire to make one pin, which is then cut off and pointed at one end.

The next operation is to bend the other end of the wire to the shape by means of a simple punch in the foot press. After this the spring portion is accomplished by the fixture as shown in the figure. The bent end of the wire is entered and located to gauge within the plate with the length of wire lying between the pins and against the forming horn. The inclined surface of the body is necessary, so as to have both ends of the wire in line with each other when fastened within the head.

To make the head of the pin, a strip of brass is fed by a pair of rolls across a drum; which coats the lower side of the metal with a film of oil, and then between a pair of press tools. These tools cut out a blank more or less of figure-of-eight form. A transfer device then carries the blank to the drawing through press, where a blunt ended punch forces the blank through a hole in the bed of the press and completely forms the cap in one operation.

The next operation is that of enclosing the bent head of the pin within the cap. This is done in the foot press by means of the tools.

But it must be noted here that the caps must be offered upto the machine in the correct position, or it will not be possible for the wire stem to be entered in place, and although there are many different attitudes which the cap may take up, it is so nearly symmetrical in shape that there is no ready means of guiding it into position.

The machineries relating to the above are manufactured by the Baird Machine Company, Bridgeport, Conn.

(U. S. A.). The speed at which these machines work produces from sixty to seventy-five pins per minute, and is practically only limited by the rate at which the drawing process works. To watch them in operation is most fascinating, as there seems to be no hurry about the work, neither is there any appreciable noise at the machine itself. Another remarkable fact is that the whole of the mechanism is contained within a farm work occupying a very small space.

The completed pins are collected from the machines periodically and are scoured, cleaned, plated, and so forth; but as these processes are common to many trades they need not be enlarged upon here.

Machines for Making Tin Boxes.

The restless age we live in makes supreme and most diversified demands on the merchant trying to hold his own against general competition and on the manufacturer who wants to sell his products. Consumers have grown more fastidious than ever before as to the beautiful and precise outward appearance and elegant make-up of the goods offered them, and producers who want to keep in the race are often compelled to provide a pleasing make up for old-established preparations and especially for new ones they are putting on the market. As a matter of course the price is of decisive importance and nothing but rationalized manufacturing methods and use of the best mechanical devices enables them to supply their customers with first class goods at low prices. It is a gratifying fact that the machine building industry has produced a good device which is easy to operate and of great value in the manufacture of products which by their very appearance make a favourable impression on customers. For this reason several preparations such as; toilet powder, tooth powder, boot polish, etc. could

be hardly sold without putting them in decorated tin boxes the demand of which is increasing by leaps and bounds in this country.

For this reason attempts are always being made to make the process of manufacture as automatic as possible. The construction of the high-output automatic folding machine invented in U. S. A. is a great advance in this direction. The machine is constructed in such a manner that it can be employed with or without a soldering device. The maximum output of this machine is about 200 ready folded and soldered tin-boxes per minute. The machine will make round, oval or rectangular tin-bodies of all kinds. If a soldering device is used, the tins can also be soldered at the same time.

The material to be handled may be lacquered or printed sheet-iron, tinned or untinned. The sheets, cut to measure, are stacked one on top of the other in the storehouse of the machine. Thus one operative is able to look after several machines. The sheets are sucked out of the magazine by means of an air-pump and fed into the machines. The operation may also be done by means of manual labour.

In a rapid succession of processes the corners are cut and the sheets are bent to form the angles. The sheet then passes into the device for bending and pressing the edge down flat, where the edge is formed and a perfect longitudinal fold is produced.

If the tins, having reached this stage, are to be soldered along the longitudinal joint, they pass from the folding to the soldering device. They are fed along the guiding mandrel of the soldering roll, whereupon the edge passes over the soldering roller proper, where the liquid solder is run into joint. While the tin is transported further the

edge is wiped and cooled by compressed air, after which, ready folded and soldered, it leaves the guiding mandrel. It can then be conveyed by machinery to a machine for fitting the bottom on.

The automatic edging machine can be easily and quickly set for another size of tin.

The magazine, the corner cutting apparatus, and the folding device can be quickly adjusted to the greatest breadth necessary. On the other hand the curving mandrel and the guiding mandrel of the soldering apparatus have to be changed for every diameter. The machine can be adjusted within such wide limits that tins of 50 to 115 mm. in diameter and upto 150 mm. in height can be made without the slightest trouble.

These decorated or printed tin boxes have now completely supersided the old board and small wooden kinds.

This machine is very suitable for the purpose and is constructed by the firm of E. W. Bliss Coy., Brooklyn. New York.

As shoe polish hardens and becomes quite useless if exposed to the air, the tins used for holding it should be so made that the lid closes down tight and firm—for it is only in this way that the contents can be kept soft and fresh—and at the same time open easily and without the slightest trouble. For the manufacture of suitable tin boxes of this kind, special machines that operate with the most exact precision are necessary. One of the latest models is an automatic tin making machine which requires no attendance and skill on the part of the operator than that of feeding the metal parts to the magazine. All the other work, the insertion of tin between the tools, the working of it, the removal and sorting of the finished tins and the removal of the waste, are all automatically carried

itself. The operator is fully protected from injury by this construction. A special feature of this new machine is a new device by means of which the machine can be adjusted from full automatic to half automatic operation by means of a lever so that if required the metal parts can also be fed to the machine by hand. This improvement enables further more articles of unlimited length to be worked on the machine, as well as those whose shape is not suitable for automatic treatment. The machine is also equipped with a hand wheel so as to enable the tools to be interchanged easily and conveniently. Another special device enables the machine to be disengaged and stopped immediately in open position by pressing a foot lever.

This machine can also be used for the manufacture of screw lids for pots, glasses on which lids with screws are used as well as for flanging the edges of lids. The formation of the thread and the edging on screw lids are done by combination tools. When flanging the edges of the lids a ribbed edge can also be made by this machine. The address of the manufacturers of above machines is L. Schuler A. G. Goppingen, Germany.

Wire Cloth.

Wire cloth is a very important article and is used in a variety of ways. It is usually woven like cotton fabrics. The looms generally employed in the production of wire-net, wire-cloth or guaze closely resemble, in general principles, those used in the textile industries, but they possess many distinctive characteristics, and these peculiarities are largely accounted for by the untractableness of wire as compared with fibres yarns. Wire will not yield so much as cotton or wool, and will break off short if over-stressed, with the result that the cloth made is defective by broken ends. Again, the specifications to which wire cloth is

manufactured are often very stringent, and a single defect in a large area may result in the rejection of an otherwise valuable piece of material. Consequently all the working parts of a wire loom have to be made with the highest degree of accuracy. Wire, also, is not so flexible as yarn, and the machines have to be run at a correspondingly reduced speed.

There is in this country only a few number of firms now engaged in the manufacture of wire cloth.

In weaving wire nets special stress should be imposed upon the machines and the operation of "beating up" is one of the principal factors in determining the design of wire looms. "Beating up" is, of course, the action of forcing by means of a "red and lay battern." Another dificulty is caused by the stiffness of the weft wire, which checks its unwinding as the shuttle goes from side to side of the cloth.

Broadly speaking, wire cloths fall into three principal groups :—(1) Such as can be woven at a high speed, which limits the size of the wire to a maximum of about No. 25 S. W. G.; (2) cloths woven from heavier wires, which can be woven automatically, but at slower speeds, from wires with a maximum of No. 15 S. W. G.; (3) wire cloths and fabrics made from wires too stiff to be shuttled automatically, which involve the use of a semi-automatic machine, assisted by handwork. The consequence is that in any factory which sets out to manufacture the whole range of cloths, a variety of machines is required, and in the following notes an attempt is made to explain the leading features of the several types.

Taking first the loom which follows more closely the practice of the textiles industries than does any other one, the first characteristic which strikes one is the great care which is bestowed on the machining

of the "warp beam"—the roll which is used to accommodate the supply of wire for the longitudinal part of the mesh to be woven.

It is obvious that the elasticity of the wires cannot be depended upon for taking up any inequalities in the rate at which the wire is supplied by the warp beam, and, as a consequence, the warp wires have to be wound on to the beam in a meticulously even fashion. The warp beams are sometimes wound or, filled with new wire, in the looms themselves, but otherwise they are taken away to separate frames for winding. In either the wire is fed into a series of deep grooves in the warp beam. Each of these grooves must contain an equal quantity of wire, or there may arise a difference in the tension of the individual wires at some time or another during the process of weaving a length of cloth. For this reason the warp beam is turned out of a solid cylinder of cast iron, and the grooves are machined with a very high degree of accuracy. The grooves are generally spaced at 1 in. centres, and consequently if, for instance, a cloth of 12 mesh is to be woven, each of the grooves will have to accommodate twelve parrallel wires. The result is that not only must the warp wires be wound very carefully, but they must be matched one with the other.

Wire for weaving must be specially well annealed, and the annealing, as affecting the relative hardness or softness, sometimes varies perceptibly in different parts of a coil. During weaving the wires stretch, more or less, and as hard wires will stretch less than softer wires, the effect of a few hard wires in a web will show throughout the whole length of cloth woven, and in closely woven cloths such hard wires may give so much trouble as to necessitate their being cut away from the warp beam.

The warp wires art not wound directly on to the warp beam from the wire-drawer's coils; but are first wound on.

to bobbins and examined during the process. The bobbins are then put in a creel, and taken to the separate beam winder, or to the loom-depending upon which system of winding is adopted. There is a little brake bearing on the flange of each bobbin to keep a slight tension on the wire as it is unwound.

The wires are led from the bobbins through what is known as a "marshall box" which is fixed on a slide bar at the back of the winder. The marshall box is fitted with five or six oval "lease rods" of hard wood under and over which the wires ore passed to produce an even tension. It is necessary that the wires coming from bobbins above the level of the box should start by passing under the first lease rod, and vice versa, or the proper effect will not be obtained. After leaving the lease rods the wires are threaded through a short length of reed, which separates and keeps an even spacing between them. Finally, the attendant keeps a light touch, with groove in the warp beam, to which each bunch of wires is first attached by looping it round a nail driven into a wooden peg sunk in the bottom of the groove.

If, in the process of winding, a loose or broken end of wire should appear, the attendant carefully twists the two ends together and marks the place with a little piece of gummed paper. The paper subsequently attracts the attention of the weaver, who separates the joint, so that the wire may go through the machine, and makes the joint again in the cloth. In weaving steel wire, the warp is generally first oiled, but no lubricant must be used with brass or copper.

The shedding action, or separation of the warp for the passage of the weft, is carried out in the same way as on textile looms, and for this purpose the wires are threaded through steel "healds."

The adjustment of the shed opening in a wire loom is a very important matter, as wire cloth is very liable to show imperfections through bad adjustment in this direction. The healds must, of course, be so set that the eyes are all in line and parallel with the face of the cloth, while the stroke of the two frames must be equal. It is usual also to adjust the warp and cloth beams to such a height that a line jointly their tops is just below—say, by 1/16 in. 1/8 in.—the eyes of the healds at mid-stroke.

The cloth beam, on which the woven cloth is wound at the front of the machine, is a heavy cast-iron roll. A groove is cut along the roll, and in this groove a bar is fixed by countersunk screws for the attachment of the warp wires when the weaving is started. In this connection, it is noteworthy that there must always be a certain length of unwoven wire, at both ends of the cloth, on account of the distance from the picking line, where the weft is shot accross, to the two beams, and it is naturally the aim of manufacturers to reduce this waste wire to a minimum.

A variety of different schemes is employed for paying out the wires from the warp beam, as the weaving proceeds, and at the same time keeping the proper tension on the warp, while the woven cloth is rolled up at the front.

The movement of the warp beam is regulated by the ratchet at the rear, which is driven by a variable stroke crank. This crank is, of course, set according to the mesh to be woven. The ratchet wheel, it will be noticed, has a very wide face, and is engaged by several pawls, set a fraction of a pitch in advance of one another, so that a very regular movement is obtained.

It is occasionally necessary to turn the loom backwards to open the shed again and pick out a broken weft wire. If this were done without releasing the take-up and let off

pawls, there would be a double mesh when the machine was started again. In the Anderston looms the ratchet wheels are free to reverse for nearly a revolution without operating, so that this trouble is overcome automatically.

The weft wire is carried in different manners according to its gauge. Thus wires up to No. 25 S. W. G. are wound on tapered pirns. in the same manner as cotton, carried by a flying shuttle. The wire comes off the end of the pirn, which does not rotate. For heavier wires, up to, say, 20 gauge, this system is not practicable, and it becomes necessary to wind the wire on a bobbin or spoon, which is carried in the shuttle and is free to rotate. In the Anderston loom the bobbin is arranged. It will be noticed that there is a light leaf spring bearing against the flanges which produces just enough braking action to stop the bobbin spinning at each end of its stroke. The wire is led off the shuttle between two little grooved wheels, which are mounted in a sliding carriage controlled by light springs, so that the wire is led fairly off the bobbin. The rolls on which the shuttle runs are set at a slight angle to make the back of the shuttle bear against the face of the reed as it is shot through the shed. The speed of a loom using such a shuttle is about sixty picks per minute.

Still heavier wires can be shuttled, but the limit is reached at about No. 15 S. W. G., and such wires are generally wound on narrow bobbins lying flat in steel shuttles. These bobbins may be about 5 in. in diameter by 2 in. wide, and the effort necessary to shoot them across the cloth together with their retardation at the end of the stroke, are serious problems for the loom designer. As a consequence, the machine can not be worked at a speed much above thirty picks a minute.

There is a demand for cloths made of still heavier wire, and for this work a semi-automatic loom has to be

employed. The weft wire is then passed through the shed of the warp by hand. The wire is wound on a needle, something like that used by a fisherman in netting, and this needle is pushed through at each stroke of the machine by the attendant.

Even stouter wire, up to $\frac{1}{4}$ in. in diameter, is woven, but then it is cut off in lengths appropriate to the width of the cloth, and if a close mesh is required the wire is crimped before it is woven.

Wire Chain Making.

Wire chains are made of all sorts of metals, from gold to steel, and while it is not general to solder the joints of steel chains, with the softer metals soldering is necessary to prevent the links opening under tension. It would obviously be a most tedious business to solder each link separately by ordinary means, so the necessary solder is provided in the body of the wire itself in the form of a core.

The billet of metal from which the wire is to be made is drilled throughout its length, and the hole is filled with solder while the billet is at a red heat. The solder used varies with different metals, as it is necessary that there should be no tendency for the two to separate on account of different coefficients of expansion, while the melting point of the solder must naturally be below that of the wire it is to unite. The cross sectional area of the solder is approximately 15 per cent of that of the billet, and this proportion is retained throughout the subsequent process of rolling and drawing down to wire.

In the making of the wire for rolled gold chain—that is to say, wire which is cased with a thin film of gold—a further preliminary operation is necessary. For this work a solid-drawn gold tube about 3 ft. long by 2 in. in diameter,

and having a wall thickness ranging from 1/10 in. to 1/32 in. is obtained, and yellow metal rod is carefully turned to be just an easy fit inside it. The rod is silvered all over, and when it is slipped into the tube and the two heated to a dull red heat the silver "sweats" the gold and the bar together. The rod is provided with a solder core, as already described, and the composite rod is drawn down to wire of almost any degree of fineness.

In this way a wire of reasonable mechanical strength can be made which has all the appearance, externally, of being of gold throughout, but the film of the rare metal is extremely thin, perhaps only 0.0001 in. thick. In the trade the rolled gold is described as being of 1/10, 1/20, 1/40 and 1/60 quality; that is, if the wire or sheet is of 1/10th. it would be 0.00025 in. for the same diameter. The length of time it takes to wear this gold away varies, of course, with the thickness of the material. The 1/10th. quality is about the best, and is warranted by the makers to wear for twenty years.

Reverting now to the actual making of the chain, it will be readily appreciated that the machine which cuts off and bends the wire into links, threading the links together at the same time, must be impossible within the compass of a single article fully to describe the whole mechanism. It is hoped, however, that the following explanation may give some idea of the process, and it must be left to the imagination of the reader to fill in the gaps, such as the driving connections between the working tools and the main shafting. It is sufficient for the present purpose to say that all the movements are effected by cams, keyed on to a single shaft and connected with the tools by levers, sometimes assisted by secondary cams or slides where it is necessary to change the plane of movement.

The machine in question is one made by Baird Machine Coy, Bridgeport, Conn, U. S. A. and is capable of turning out about 100 yards per day of eight hours according to the number of links per inch of chain, as every revolution of the cam shaft completes one link.

The stock of wire is drawn off the bobbin through a simple straightener by a feed slide. This feed is given a stroke equal to the length of wire necessary to make one link by the rocking lever indicated, and during the forward stroke the wire is gripped by the pressure of the cam plunger. On the return stroke the pressure is released. The feed block, by the way, slides under the end of the plunger. The wire goes on to a second grip, on which the second plunger presses during the return stroke of the feed slide. Emerging from the grip, the wire is projected across a gap against a stop and is then cut off by a vertical tool, which just does not touch the anvil below, a very accurate stop being provided to limit its stroke.

Now, assuming that chain making has already been started, there will be a link in the gap of the machine, and the new piece of wire will be threaded through this link. Directly below the gap there is what may be described as a two-jaw chuck on a verticle spindle, through which the chain is delivered. When the wire is threaded through the last link the chuck jaws will be opened in the position and the chain is then supported by the bridging wire. At this moment a horizontal mandrel, the end of which as indicated comes forward over the wire between the jaws of the chuck, and by moving downward bends the wire into the form of a U. It will be noticed that there is a little groove on the lower side of the mandrel to accommodate the top of the last made link. The jaws of the chuck close on the U just formed and the mandrel retires. A closing tool then descends from above and, by a steady

pressure, succeeded by a sharp blow, bends the limbs of the U together to form a closed link. The chuck retains its grip on the chains and makes a quarter revolution, rising slightly at the same time, so as to present the link in the proper position for the next wire to be threaded through. Immediately the chain is supported by the wire again the chuck returns to the position indicated in the sketch and the process is repeated. The mechanism for opening and closing the chuck will show that the two jaws are replaceable, pieces rockers pivoted between the cheeks of the body. The shank or spindle of the body is bored and accommodates a hollow rod which spreads out at the top to form a T head. This head bears against two adjusting screws on the rockers, and when the rod is pushed up the jaws are closed on the chain link. The lever for pushing up the rod and the spring for its retraction can be plainly seen in the base of the machine.

It will be seen that the chain made is continuously rotated by the chuck, and if it were allowed to accumulate on the floor with the twist in it would become so entangled as to be useless. For this reason a turntable is arranged beneath the machine and is rotated at a quarter of the speed of the cam shaft, so that the turns are taken out of the chain as it is made. This turntable is a simple affair, arranged beneath the bench that carries the machine and is driven by a gut band from the cam shaft.

Making of Paper Clips.

The use of paper clips is almost universal all over the world for holding sheets of correspondence together and there is a rising demand for these in India also. The manufacture of these familiar clips will thus provide a new opening to young industrialists who would like to take to some mechanical industry.

The wire is drawn off a swift, through a set of straightening pegs, and a through a tunnel cutting off die, by a cam near the driving pulley, on the left. The wire is cut off to length and immediately two of the slides, in the centre of the machine, descend and bind the wire into the form, round a pair of projecting pegs. The second operation is to bend the left hand and round again, by means of a horizontally moving tool. This slide then recedes and another of the vertical tools comes down to make the bend. In the interval, the peg on the left, round which the wire was first bent, has of course, receded. Another movement of the left horizontal slide produces the formation and a stroke of the corresponding horizontal slide on the right completes the coiling of the clip to the shape.

In some cases the clip is then considered as being complete, and the pegs, round which it has been formed, recede, so that it may fall clear. The better class of clips, however, have the end of the first loop bent slightly out of plane, to give the clip a free lead on the edge of the paper, and this bend is effected by a transversely moving slide in the front of the machine.

All these operations are effected by means of cams on the single main shaft running across the machine, and the precise form of the clip is naturally dependent upon the shape of the tools and the sequence of their operation. The rate of production is some 90 clips per minute. The machine regarding the manufacture of these articles is constructed by the Baird Machine Company, Bridgeport, Conn., U. S. A. and as far as we know they will readily supply full explanations to all interested parties.

METAL-WARE INDUSTRY.

The manufacture of metalwares is perhaps the most important of all the industries in India. Most of the Indian

household utensils are made of metal; hence metal takes the place of the porcelain and glass of Europe. The utensils now generally used are made of brass, bell-metal, copper, copper with an inside tin coating, sheet iron enamelled on both sides, and aluminium.

ALUMINIUM WARES

Aluminium is especially popular at present for cooking utensils, etc. This is due to the fact that sheet aluminium can not only be worked into cheap and durable cooking utensils for different purposes, including boilers, cookers, kettles, pans, pots, roasters, trays, etc. but is easily heated. Moreover, the aluminium utensils have a pleasing appearance and are easily kept clean. The pure metal has little harmful effects on food products, and gives rise to no poisonous compounds on interaction with foods. The impure aluminium however is not without injurious influence on health and should be avoided in making utensils.

The only drawback that somewhat qualified the universal approval of aluminium kitchen utensils is the fact that the handles of pots and saucepans, made of cast aluminium, will become excessively hot on the heated kitchen range. But since this undesirable feature has been successfully eliminated by providing aluminium cooking utensils with well insulated handles, housewives everywhere are getting steadily more interested in them.

Preparation of Sheet Aluminium.

The making of an aluminium ware begins with the virgin aluminium ingot. This is form in which aluminium comes into the factory. The first step is the melting of the virgin aluminium ingot. The ingots are melted in a heating furnace under a heat of 1,450 degrees Fahrenheit. The dross or refuse metal is skimmed off, as only the pure metal is use for the best ware. Also it is customary to fuse and

mix with the virgin ingots the scrap or remains of sheet aluminium from stampings ; but the amount of scrap in all cases may not exceed 25 per cent. It is believed that a low percentage of scrap used in the mixture insures elasticity and tensile strength.

To use the aluminium thus made, it must be rolled into sheets. Before this can be done it must be moulded into slabs of suitable sizes. After this step the slabs must be heated to a high temperature preparatory to " breaking down " into plates. This "breaking down" or rolling and cross rolling under eight tons pressure reduces the slabs to plates of about $^1/_4$ inch to $^1/_2$ inch, according to the thickness finally desired. The plates are "cold rolled," that is, they are not heated as in the case of the slabs. During this rolling stage every pass through the rolls increases the hardness of the sheet, and hence the tensile strength of a very thin sheet would normally be considerably greater than that of a thick one. The rolling machines are adjusted in such a manner that the sheets are rolled thinner and thinner progressively till the desired thickness is arrived.

Annealing.

During the working of sheet aluminium into shaped bodies by drawing, heating, or other means, the metal hardens and it would be the aim to select such a temper to start with that the finished articles are dead hard. If, however, the amount of shaping to be done is excessive, it may be found that sheet of the softest temper becomes too hard for further work before the shaping is completed, and a process of annealing is then necessary. Annealing is extremely simple, and merely involves the raising of the metal to about 400°C by immersing it for a few minutes in a bath of oil and cooling either naturally or by plunging into water. No scale is formed during this heating, so that the

pickling process necessary with iron and copper is not required, and the metal is ready for continued work immediately on cooling.

If the shape and size of the article permits, the best heating medium is a muffle furnace in which the metal is uniformly heated by radiation, and the temperature can be adjusted and measured accurately by pyrometer. In the case of large sheets used by panel beaters a gas blow-pipe is used which is played upon the sheet until its temperature attains the requisite value.

In case of repetition process, where a large number of identical objects are to be produced, the annealing should result in a constant degree of softening for each bath of metal dealt with, and for this reason it is desireable to use a muffle furnace, a bath of molten salts, or some other device which can be maintained at a definite temperature, and with which the period of exposure to the heat can be accurately adjusted. The time required depends upon the temperature employed, and to some extent upon the purity of the metal. According to Carpenter and Tavenor complete softening of the metal of 98 to 99 per cent purity requires a time of well over 500 hours if the annealing temperature is 250°C but that at 350°C about 24 hours is sufficient.

After the annealing is done, the sheet is ready for stamping into an utensil, and the operations from this point are probably the most interesting to the layman. Just as one would scarcely believe from examining a well made aluminium utensil that the raw material from which the metal is extracted, is clay, so it is difficult to conceive how this unique creation, with no dirt-catching crevices or no riveting or clinching work on it, is manufactured out of a flat sheet of aluminium.

Drawing, Pressing and Stamping.

As pointed out, dead soft annealed aluminium sheet is very ductile in the cold, it can be readily drawn and pressed into various shapes, and the usual draw-press operations employed for metals in general are applicable in the fabrication of aluminium objects. Aluminium cooking utensils and other wares are fabricated by drawing and spinning, and the substantially pure metal is especially adaptable to drawing, pressing, spinning, and stamping. For this reason care must be taken in melting the ingots and refining away the dross.

All drawing and pressing of aluminium is done cold, and usually dead-soft annealed metal is used.

In stamping, the sheet of aluminium is fed into a stamping press, the dies meet and the result is an object with sufficient form to suggest a cooking utensil. Owing to the pliability and ductility of aluminium a perfectly flat sheet can be stamped easily into graceful shapes. The stamping is done "cold," there being no heat applied. There is a second stamping and re-stamping, known as, "drawing". The "drawing" process progressively shapes or designs the utensil. Some utensils are given as many as ten or twelve "draws." The characteristic of the metal of being drawn perfectly depends upon its purity.

Lubrication.

Owing to the clinging nature of the metal, however, the stripping plates of draw presses require careful design, and the surfaces of the dies must be kept bright and polished. Blanking dies may be made of cast iron with hardened steel in the interior, and punches may be of soft tool steel. In draw press work on aluminium, lubrication is very important; but the proper choice of a lubricant greatly facilitates the work. Aluminium should never be worked dry, and for

deep drawing a thick lubricant such as vaseline or heavy machine oil is the best. For blanking or shallow stamping a lubricant is not so essential, but the use of paraffin oil is recommended because it provides a cleaner cut and at the same time prolongs the life of the tool and assists in stripping.

Diameter of Circle Blank.

In drawing cooking utensil shapes, the diameter of the circle blank required to produce a shell of given size can be readily calculated from the requirement that the area of the blank must necessarily be not greatly less than the area of the shell. Thus, if D be the diameter of the blank; and A be the area of the shell, then

$$A = \frac{11}{14} \times D^2 \quad \text{or} \quad D^2 = \frac{14}{11} \times A$$

In calculation it is assumed that the blank is sufficiently thin to withstand the change of shape encountered in drawing without marked alteration of thickness, and that all corners are sharp.

Ironing.

After finishing the drawing and stamping operations let us now pass on to the process of rolling or ironing in order to remove the wrinkles, that is to reduce the thickness of the ware slightly without much altering its shape. This is a very effective operation which closes the pores of the metal and hardens the surface, thereby leaving the metal very uniform in thickness and with a fine, smooth surface capable of taking a high polish. The above are the general operations usually followed for the manufacture of aluminium utensils.

Method of Spinning.

Spinning is one of the oldest of the sheet metal working processes, and though, for repetition work, it has largely

been superseded by press working, it still remains a useful process for certain special applications. The cost of dies for press work is heavy and would not justify the use of the press for articles required in small number, whereas the chucks necessary for spinning can be made for much less cost. Spinning also provides a means of economically obtaining complicated re-entrant forms which could only be produced on the press with considerable difficulty, and a still further special application of the spinning lathe is the production of extremely large work, the manufacture of which, in a press, would be practically out of question.

Tools.

Besides spinning machine there are various types of tools commonly used in this operation. Of these, the round-nosed tool is always chosen for commencing. The raising up tool is used for dishing concave towards the lathe head, and the lobs on either side may be used for forcing the metal into an under-cup lip. The turning over tool is used for convex surfaces. The " knob raiser " is used for concave dishes or for forming a wide groove in the periphery. Narrow grooves are formed by the groover, which is used by placing the end under the work and pressing the handle downwards, the 'tool rest' acting as a fulcrum. The 'planishing tool' is used for smoothing or burnishing and is also applied to the underside of the work. The trimming tool is used to cut off the edge in shavings.

In the spinning process a 'former' or chuck shaped to the interior form of the article is rotated at high speed in a lathe. The blank is held against the end of the former by a wooden holder carried in the tail stock of the lathe, the back centre being arranged to rotate.

The blank rotates with the chuck, and the worker forces it round to shape by pressing with hand tools, with a lever action pressing on a pin in a tool rest. As the blank is forced down to shape, the fulcrum is moved along, the spinning rest being provided with a series of holes for the purpose. When the blank finally fits the shape of the chuck, the edge is trimmed by a diamond-shaped cutting tool and, without stopping the lathe, the back centre is withdrawn, the shell slipped off, and a new blank put in place for the next ware.

The blanks used are lubricated during the work with a thick machine oil or vaseline, applied by means of a rag. The tools used must be finished with very smooth surfaces, and are usually of tool steel heated at the end quenched, without tempering, so that the working faces are almost glass hard while the shrank is comparatively soft and hence not liable to crack. The working surfaces are kept well polished by occasionally rubbing them on a strip of leather glued to a piece of wood and sprinkled with putty powder.

Finishing Aluminium Wares.

Aluminium can be finished with special surface effects so as to be more attractive; and polished and frosted finished are usually given to aluminium cooking utensils. This frosting effect is however produced by simply dipping the articles in alkali solutions but a variety of frosted finished is made by scratch brushing. In producing this frosting effect the article is first cleaned of all dirt and grease by rubbing with benzol on a cloth, or by dipping in a saturated solution of sodium carbonate or dilute sodium hydroxide solution. The part is then immersed in a strong solution of sodium hydroxide maintained at the boiling point; immersion is continued until the metal is entirely blackened when it is rinsed off in cold water, and then dipped in cold

concentrated nitric acid. The part is held in the acid for one or two minutes until the black discolouration is removed and the part attains a white frosted appearance. A mixture of equal parts of concentrated nitric and sulphuric acids may be used instead of the nitric acid alone. After dipping in the acid the part is washed again in cold water and then dried out in clean sawdust.

Scratch Brushing.

By this process aluminium articles can be given an attractive finish. In applying a scratch brush finish, the article is revolved on a lathe and fine scratches made on the surface by holding a fine steel or brass scratch brush against it or the scratch brush may be in the form of a wheel revolved at high speed on a lathe, and the article to be scratched is held against the wheel. Such a scratch surface will have the appearance of stain, and will diffuse light rays with pleasing effect.

Polishing.

Aluminium may be given a very high and bright polish which it readily takes, and polishing is an usual finishing operation on utensils. The degree of polish depends upon the hardness of the material and its porosity. The method varies considerably in different plants. In general, the part to be polished is given preliminary treatment on a cloth wheel with a fine powder like tripoli and a lubricant like kerosene, and finished with finer tripoli. The method, however, is carried out in four stages, viz. ragging, oiling, buffing, and colouring: (1) Ragging is done by using a wheel made of old sewn buffs glued together to form a solid mass ; 80=mesh emery powder is glued into the surface. The wheel rotate at 2,400 times per minute applying freely a lubricant to the wheel surface during the operation.

(2) Oiling is performed by using a solid felt wheel; 120-160 mesh powder embedded in glue is abrasive, applied to the wheel surface, and the same lubricant as for ragging is used.

(3) Buffing is done in a wheel made of sewn rag buffs, separated by spacing pads. After buffing, the article is washed in benzol and dried in saw dust.

(4) For colouring, a colouring wheel similar to the buffing wheel is used. Tripoli and white diamantine polishing powder are used. The operation is known as colouring because the characteristic bluish white colour of aluminium is well brought out.

Cleaning.

For cleaning stampings, utensils and other fabricated articles, oil may be removed by washing in scalding hot water with soap, or by wiping with benzol, carbon tetrachloride, or gasoline, followed by rinsing in soapy water and then hot water, and drying.

Now it may sometimes happen that the utensils are left with the dealer for an appreciably good length of time. In this case, though it is claimed to be "rustless" it will not retain its brilliant polish by the continued action of damp-air. This necessitates periodic cleaning. A satisfactory method of treating a polished body is to give a regular wash with clean water then it is dried off and finally rubbed up with a clean duster. Polishing is then done with an ordinary good quality liquid metal polish; but a better result is derived by rubbing the article with a mixture of whiting and paraffin oil.

Soldering Aluminium Wares.

The difficulties in soldering defective aluminium wares arise from the high heat conductivity of this metal, and from the fact that ordinary soldering fluxes will not clean the

surface of the metal. The heat is conveyed from the soldering bit and from the solder so rapidly that the solder does not become sufficiently liquid to flow readily. To overcome this difficulty, the spreading of the heat must be restricted. The difficulty increases with the size and thickness of the pieces of aluminium to be solderd. The pieces should, if possible, be warmed before hand, and for large work the soldering bit should be hotter than usual. Aluminium is properly supposed to be non-oxidisable, but really the surface is covered with a very thin film of oxide, which prevents the solder from alloying with the metal. This coating must be removed before applying the solder. For this reason the parts to be soldered are dipped for a while in caustic soda solution and then into strong sulphuric acid.

For soldering aluminium, a good effective solder is prepared with bismuth, 10 parts, zinc, 30 parts ; and pure tin, 60 parts. The bismuth and zinc are first melted together and the tin is added to it. The heating is further continued. The molten mass is then poured in moulds to make sticks of about 1 ft. long and about the size of a pencil.

The pieces to be soldered are held with a vice and are gently heated with a blowpipe flame until they are hot enough to melt the solder, when it is applied. The surface is then scraped with a file. The solder is melted on to each piece and is worked round with a short rod of nickel-aluminium. The parts are held together for a while, the blowpipe is removed and then the parts are allowed to cool.

Soldered joints of aluminium, even when well made, are not as strong as soldered joints of other metals, and as a result of the galvanic action between the solder and the metal the joint will gradually disintegrate.

Making of Cups.

It will be noticed that in planning the number of operations and the form of the intermediate cups necessary for the production of any final shape, the designer must give consideration to the thickness of the metal and to form of press available. With a double action press in which the blank is held rigidly during the drawing, the amount of reduction per operation can be very much greater than that with a single action press, where the danger of wrinkling is much more pronounced. Under the best conditions, using a double-action press with dies the diameter of the first cup can be from 50 to 60 per cent of the blank diameter, and in subs equent redrawing operations the percentage reduction in the diameter of the cups can be about 25 percent. Smaller reductions would be desirable with dies of the simple "push through" type, or if the shell is tapered ; or if the metal is ironed.

These points may be illustrated by a special case such as a tapered cup. This is to be produced from a $5^{3}/_{4}$ inch blank, initially 0.036 inch thick, but reduced during the working to 0.028 inch. The general procedure will be to draw a series of straight sided cups until the last operation of all, where the taper will be given, and hence it is evident that the last cup but one must be a shell about $2^{5}/_{8}$ inches diameter.

The heights of the various cups are, of course, fixed by the amount of metal in the blank, it being assumed that no trimming is done during the working. It is interesting to note that even if no ironing operation were required, it would still be necessary to employ four drawing operations for the production of this cup.

Tea Kettle.

We all of us are now-a-days familiar with aluminium tea kettle and must have noticed that a finished article is

not a straight side receptacle. Its walls are curved inward and the opening has much smaller circumference than the bases. The process by which this can be done, is called the "spinning" operation. A sectional die, called a split chuck, is placed in the receptacle. This is then placed on a spindle, and as it revolves at high speed, the operator shapes it. This is also done cold, there being no heat applied. The elasticity of the metal makes the process possible. After this work, the split chucks, that is, the sectional combination dies are removed.

An important step in the manufacture of tea-kettle is the stamping of the pattern and this not only adds beauty to the design, but also gives additional strength through the angular structure. After stamping the pattern, "ears" must be welded or rivetted on the attaching the "bail" of the kettle. The spout of kettle, which is in the meantime made by casting is next welded on one side of the kettle having a series of perforations for decanting a liquid. This welding is, of course, done with an oxy-acetylene blowpipe. The joint made is practically perfect, making the tea kettle almost one complete piece. Then the article is submitted to the subsequent operations of buffing and polishing. After this the name and trade mark of manufacturers are imprinted at the bottom of the kettle. The finished article is now sent out to the market for sale.

Aluminium Frying Pans.

Frying pans are nothing but a tray with a comparatively high edge provided with a handle. These are made out in a similar manner as the cup by the method of drawing and stamping a full description of which is already indicated in the general process. The handle which is made by sawing and hammering rectangular blocks of aluminium, is lastly riveted to the edge of the pan.

Making of Brasswares.

Brass and copper vessels of various shapes and sizes are in use in India from time immemorial. Although the use of brass utensils for domestic purposes has been hampered to a great extent by the advent of enamelled and aluminium wares still its maintains it supremacy in some particular sections as in the days of old.

Brassware is generally made from brass sheets either by method of hammering or by casting. In the former process, which we shall only deal with for our present purpose, the brass sheets are first heated in a furnace in which no draught is used, and then submitted to the hammering process.

Hammering or Beating Process.

When they are hot, the sheets are taken out from the furnace and beaten out in lots of two, four, six, etc. the number that can be simultaneously beaten once separately, before the actual heating commences. The plates are then replaced in the furnace. When red hot, one plate is withdrawn with a pair of tweezers and placed on an anvil, and while turning on the anvil it is struck with a hammer with much dexterity. As soon as it begins to get cold, it is replaced in the furnace and a second set is withdrawn. In a similar way it is beaten out. The resulting plates are about 1/10th. of an inch thick. A circle is then drawn on them, roughly, corresponding with the size of the vessel that is to be made ; the circle is either scratched on the plate with a pointed compass or marked out with chalk. The plates are then replaced in the furnace, and when red hot the circle drawn on them is cut out with a pair of clippers. The plates are then held in a slanting position on an iron slab, which has a groove in it, and hammered with a mallet round the edge till a side is raised.

This hammering operation is continued further till the plates are converted into vessels of desired shape. The rough edges of the plates are filed. After pickling and cleaning, the embryo vessel is placed in an earthen pot filled with water, in which the dried skins and stones of the mango fruit have been steeped; there it remains until the metal becomes of a yellowish tinge. It is then taken out, rubbed with sand and polished with tamarind leaves. Finally it is scraped clean with a chisel, a most painful process to assist at. The *thali* is at this stage nothing more than a flat plate, with curved sides; sometimes nothing more is done to it than this, but generally it is passed on to go through a further process of hammering on various types of anvil. In making *thalis*, however, the number of anvils used is small, but in the production of more ornamental vessels as many as six may he employed. The first anvil on which the *thali* is placed is a short blunt-headed iron anvil. The operative holds the *thali* against the anvil and adds a new feature to it by beating out a sloping side, so that in its final state the ordinary *thali* is divided into three portions, the bottom, the sloping side, and the vertical edge.

The *thali* is then placed on a sharppointed anvil in such a manner that its centre coincides with the point of the anvil and is given with hammer a sharp blow. After each blow the tray is shifted on by about 1/8th. of an inch in an outward circular direction, leaving behind a bright mark. After the bottom of the tray is marked, the same simple pattern is raised on the vertical rim, leaving the sloping side plain. The contrast between the bright and dull surfaces has a pleasing effect and gives an appearance of finish to even the commenest tray. Sometimes the trays having been beaten into shape on the anvil are finish-

ed by polishing with a chisel on the lathe, the manipulaton of which will be treated later on.

Sometimes the articles are made in sections. The pieces marked out according to the shapes and sizes are cut and separated from the sheet with a chisel. These are then hammered with an wooden mallet on an anvil until each piece assumes the required shape. The sections are then exactly fitted with a hammer. Afterwards they are to be heated and joined with solders, the composition of which is 3 parts of brass and 1 part of zinc. When cool the superfluous solder is removed with a file.

The second method consists in obtaining molten brass and pouring the molten mass into a mould of the required shape. This casting process naturally falls into two sub-divisions, moulding and casting proper. This method is extensively adopted for the manufacture of small articles, which cannot be produced by the hammering process. It is for this reason we have treated this process inexhaustibly under "Cabinet Brass Foundry."

Stamping Brassware.

The modern method of giving initial form and shape to brass articles is by drawing and stamping. Rolled sheet, and not ingot, is the material used and the metal being laid upon a stamping press is forced to take up its shape by the pressure applied to the upper die. The brass sheet having been previously annealed can be stamped easily into graceful shapes. There is a second stamping and restamping, which gradually gives the desired shape, to the article. A detailed description of this process has already been discussed in the manufacture of aluminium wares ; hence it need not be discussed here.

We have now brought to the notice of our reader to the point at which the roughly shaped articles are subjected

to the interesting processes of polishing and colouring to render them presentable for the market.

Polishing Brass Articles.

To polish the articles of brass, the bottom of the cleaned vessel is fixed with rosin to a cylindrical wooden hand lathe, and this is made to revolve backwards and forwards by means of a rope. The labourer holds in his hands the double ended rope, and the artisan applies various types of chisels to the revolving vessel. These chisels are : flat, oval, and elongated. The first kind is used for convex and the second for concave surface. The elongated chisel is used for chiseling the inside of tumblers. The vessel is rubbed with oil, hair, brick dust, lard, and rag as it is chiselled and gets a fine polish. The rim is made in this last process of chiselling. As soon as the articles are polished, they are lacquered.

Colouring and Lacquering Brass Wares.

To carry out this operation successfully it is absolutely essential that the metal to be coloured shall be perfectly clean. This is of course, done over an open fire as any dirt, grease or oxides on its surface will prevent the solutions from acting evenly. When the work has been cleaned it should not be touched by hand, or even exposed to the air for longer than can be helped. All borax should have been removed and all filing and polishing of the surface completed before the colouring is undertaken. A copper wire may be fastened to the article for suspension into the bath of dilute sulphuric acid, which may be made with two or three parts of water, and one of acid ; but the old acid that contains a small quantity of copper, in solution, is frequently preferred. The work is allowed to remain in this solution for one or two hours, according to the strength of the acid. It is then well rinsed in water,

and scoured with sand applied with an ordinary scrubbing brush, and washed. The pickling bath is made by dissolving one part of zinc in three parts of nitric acid and eight parts of sulphuric acid. Heat is then applied and when the liquid is boiling the work is plunged into it for half a minute, or until the violent development of nitrous vapour ceases, and the surface is getting uniform. Then it is plunged into clean water, and well-rinsed, to remove the acid. The ordinary dark greyish-yellow tint, which is very often produced, is removed on immersing the work again in nitric acid for a very short time. Then it is plunged into clean water, well rinsed to remove the acid and placed into sawdust to dry. To prevent the action of the atmosphere it is lacquered, the process is rather difficult to execute properly, especially on large surfaces, where the tyro will find the lacquer continually getting a smeary look. The article is gently heated, and a pale varnish prepared by dissolving seed lac in alcohol is thinly applied over the surface with a camel-hair brush. If the work is too hot it will burn the lacquer, and if too cold this will not set hard.

Cabinet Brass-Foundry.

If you glance round a well furnished apartment, you will notice a lot of brass srticles attached to the furniture. This comprises the cabinet brass foundry. There are other branches of the industry entirely distinct and separate from this, which we have treated under their respective heads, such as, tube drawing, hinge making, shoe eyelets making, etc. These are mostly carried on as independent trades by manufactures who produce nothing else. The rolling of sheet brass may also be said to belong to the trade, but as that is generally performed in large metal rolling-mills, we have nothing to do with that either. The cabinet brass foundry is comprised of all the "little things" which are

made of this beautiful and useful metal, such as brass knobs, sash-fasteners, letter clips, paper weights, curtain rings, door rings, hat pegs, cup board fastenings and bolts, stair rods, and an infinite number of miscellaneous and incongruous articles, from idols and toys to brass headed nails. These articles are produced in the first place either by casting or stamping. If by the first, they are spoken of as wrought or solid work. In casting the brass ingots are melted in a specially constructed furnace and poured in sand moulds of desired shapes, These moulds are made in an oblong square form composed of two stout rims of iron, with front and back boards, and wooden screw clamps to hold the whole firmly together. Filling one half of this box with sand which is then kneaded down tightly and levelled with a straight edge, the patterns are pressed down upon it, placing them flatwise of sidewise according to their shape, and are buried in the compact bed. Dry dust is then put by shaking over the surface from a bag and the other half of the box is next fitted on its top It is now filled with sand also, pressing it well down and stamping on it. This last operation is, of course, performed by the operator with his feet. The top board is then laid on, the mould turned deftly over, and the first half lifted off, when the sand will part cleanly at the middle, leaving the patterns behind in their second bed.

They are now carefully picked out one by one, so that the mould when put together contains a perfect print on each of them. But before the two halves of the mould are joined, channels are made for the metal from the pouring holes in the iron rim to the prints, by scooping out little gutters in the sand, connecting the tow or more prints where necessary in the same manner. In the case of hollow castings the cores are placed. This is a delicate process, sometimes requiring great care and dexterity.

A little explanation is here necessary as to the construction of pattern and cores. The patterns for small articles are perhaps first of all roughly shaped in wood, and a casting then taken in lead, which is trimmed down nearer to the final size and fashion. A second casting in brass enables the pattern maker to produce a perfect model by filing, turning, or otherwise shaping it, as required. Should an ornamental design is intended to appear upon the article, it must be now modelled upon the pattern in wax, and a third casting taken, which must be cleanly finished and chased up. This sort of pattern making requires a considerable mechanical knowledge and skill on the part of the operator, who must know exactly how to adapt his article to the purposes for which it is wanted.

He must not make a pattern that it is impossible to cast, and especially he must take care that, however intricate it may be, its sides and angles must be so inclined as to leave the sand. If it is to be a hollow casting, the pattern must be made hollow, but on the contrary, must have projections upon it, in addition to being solid throughout. Thus, if the article to be cast is of hollow cylindrical shape, a core mould or box will be constructed. The matrix of this mould will be a correct copy of the interior shape of the cylinder, with elongations at the two ends. This box dividing into two halves, enables the caster to obtain a reverse model of the interior in moistened and compressed sand. It is then laid on the mould after the pattern has been taken out, and the metal will run round it, filling up the space between that and the outer print. The pattern-maker has therefore to leave on his first model projections corresponding to the elongated ends of the core, so that they may leave a print in the caster's mould, and enables him to lay the core exactly in its proper place. Allowance must be made at each step of the process for

the shrinkage of the metal while cooling, so that the final pattern may be just sufficienly larger than the article to be casted from it. Should there be deep indentations or under-cuttings in the pattern, which should tear away part of the mould on being lifted out, the caster has to resort to a process called false coring, which is the most difficult of all the operations. These interestices are first filled with moistened sand, which is then well dried and made smooth. This produces an artificial surface, capable of leaving the mould easily. When a good print is procured from the pattern metamorphosed, the cores are carefully picked out from the pattern without breaking them and introduced in the mould in their proper places, the greatest nicety being requisite, until the matrix is complete. The whole of the moulding frames having been prepared for the entrance of the metal, and screwed up tightly are kept in a row in an upright position with mouths uppermost. At this stage the operator tying a piece of cloth over his mouth to guard against obnoxious fumes of the metal, lifts the crucible containing the molten brass from the furnace and quickly pours a little of the molten metal into each hole until it comes gurgling up to the top. A few minutes suffices for the operation, and the metal, which is of a dull coppery red when melted, sets immediately, so that no time need be lost in breaking up the moulds. Each in turn is lifted up into the trough, unscrewed, and the contents, sand and castings together, tumbled in a heap. Some will be found to be inperfect, the metal not having reached the extremities of the point, while some will be damaged from the sand having broken down, but the majority will be clean sound castings, beautiful in their newness, and perfect copies of the patterns. When cooled sufficiently they are picked out from the still smoking heap of the mould, beaten to free them from the adhering particles, and broken off from

the "gets," which are the thin strips of metal filling the connecting gutters. To mould each small article separately would give the caster endless trouble so that a number of patterns are connected together in a central stem, with branches springing out on either side and at the end of each branch there is a pattern of the article. A quantity can thus be moulded at one operation, effecing a great saving of time. But little now remains to be described in the casting process. The cores, which are by this time baked hard, have to be picked out of the hollows, the sand brushed out of the bends and corners and the castings are ready for storing. An allowance of 5 or 6 lbs. per hundred weight is made for waste, as at each re-melting some part of the volatile zinc will fly off, especially when the metal has to be heated to a high degree to produce castings of a fine and intricate pattern. The extreme delicacy of detail obtained some-times is really surprising.

A beautiful method of obtaining highly finished castings has recently been introduced in America. The mould is made of the finest sand, faced with wood charcoal reduced to an impalpable powder. It is forced by extreme pressure to take every line of the pattern, and the hot metal is also machanidally compressed into all the delicate markings of the mould. Castings from chased and engraved surfaces are thus produced which are scarcely to be distingushed from the originals.

The other method of giving the initial form and shape to brass articles is by stamping. Rolled sheet, and not ingot brass, is the material used for this purpose. The metal being laid on the die is forced to take up its shape by repeated blows. Much saving of weight is thus effected, and brass becomes applicable to a variety of ornamental purposes in which lightness is a desideratum. The full

description of the stamping process is discussed in our previous article.

Brass Hinges.

Brass hinges are now a days extensively used in attaching doors, windows, shutters, box lids, etc. Their demand is keenly felt in every quarter. And as there are very few factories now engaged in producing these articles in this country, one can easily manufacture them profitably with but one or two machines.

There are two distinct forms of hinges in use, and numerous modifications, probably all derived from these two styles. The first is where the joint stands out equally on both sides, and the other is where it is placed on one side only.

Hinge Blank.

It is of the latter style that the following treats. The general construction of ordinary or butt hinges can so readily be perceived by anyone who will take the trouble to look at a hinge that a ledious verbal description may be omitted. Suffice to say, that it consists of two flaps connected by a wire, on which they are moveable to a certain degree. The flat side of hinge is known as the front, while its reverse as the back. By back, however is often understood only the rounded part, which is visible when the hinge is fixed and the door or whatever it may be attached to, is shut. In finer qualities of hinges the backs are often polished and lacquered ; the fronts may be finished in the the same way. Beyond also this, it is hardly necessary to refer to quality, which varies considerably, both in weight of metal and general style. Roughly speaking, a good hinge is one is which the parts work smoothly against each other without twisting or straining.

It may be of interest to note that the joint of a hinge is usually unequally divided. One of them has two projections, and the other three. However, many of these there may be, it will generally be found that one side has an even number and the other uneven ; thus, the total is an odd number. The side with the even joint pieces however is technically called the " double " and the other " single."

Having given a fair idea of hinges let us pass on to the mode of construction of a brass hinge. A brass rectangular plate of desired thickness is taken. And the two parts of the hinge are perforated and blanked out with a number projections in one piece, this being done in order to save stock and also reduce the operating time. There is no waste by this method, as will be seen from the illustration.

In the next operation the two parts are separated and the end formed. This is, of course done in another machine. The blanks are fed into this machine through the hopper. They pass out of the machine with the projections bent to form cylindrical tubes for the passage of the pin. This type of machine works with such efficiency that three-inch brass hinges curl at the rate of 65 per minute. Now on putting the consecutive sections of the blanks together a stout wire of sufficient cross-section is passed through to fit the holes so as to form a hinge. After this, the ends are splayed to keep it in place. The ends of the middle section of the tube will require a little filing so that it can move freely without twistiug or straining. Now three or more equidistant holes are drilled if not done previously, on eaeh flap. The finished hinge is then polished and coated with varnish and packed in card-board boxes.

Making of Brass Tubes.

The making of brass tubes is another branch of brass industry. The rolled metal is cut to the desired width by

means of a revolving disc ; in making tubes of larger diameter, however, the metal is partially curved in its length by means of a pair of rolls. In this condition, it is passed through a steel hole or a die, a plug being held in such a position as to allow the metal to pass between it and the interior of the hole. Oil is used to lubricate the metal, the drawing apparatus being a pair of huge nippers, which holds the brass and is attached to a chain and revolves round a cylinder. The tube in its unsoldered state is annealed, bound round at intervals of a few inches with iron wire, and solder and borax are applied along the seam. The operation of soldering is completed by passing the tubes through an air stove, heated with " cokes " or " breezes " which melts the solder, and unites the two eyes of the metal, forming a perfect tube. It is then immersed in a solution of sulphuric acid, to remove the scaly deposits on its surface, the wire and excess solder having been previously removed ; it is then drawn through a " finishing hole plate " when the tube is completed. Mandril drawn tubes are drawn upon a very accurately turned steel mandril ; by this means the internal diameter is rendered smooth. The tubes drawn by this process are well adapted for telescopes, syringes, small pump cylinders, etc. The brass tubes for the boilers or locomotive engines are now made by casting and drawing without being soldered and some of them are drawn taper in their thickness. Tubes from 1 /10 inch internal diameter and 4 or 10 inches long, up to those of two or three inches diameter and 4 or 5 feet long, are drawn vertically by means of strong chain wound on a barrel by wheels and pinions as in a crane. The fluted tubes of pencil cases are drawn through ornamental plates with elevations and depressions corresponding to the impressions left in the tube

Brass Eyelets.

This small article of brass is extensively used by the shoe-makers, etc. Its construction is such that it is very difficult for a layman to have an idea about the manufecture of this tripling object.

The method of its production is so easy that it can be readily understood from the strip as shown in the diagram. A comparatively large and shallow depression is formed at first by the punching machine as shown in the illustration. The strip is then fed forward so that a smaller and deeper depression is made by the succeeding punch, and so on till the fourth punch, when the end is trimmed off. A novelty is here introduced, in the method of trimming the solid end. Instead of piercing the hole with a round punch, the end is sheared off with the machine thereby saving splitting when the eyelet is turned over in use. The type of machine generally used for the purpose is fitted with a automatic clutch so that it can be started and stopped instantaneously. The friction block, which is a necessary feature of this stop mechanism, is automatically taken off when the machine is working continuously.

The eyelets are then ready for receiving enamels, which are made of various colours to match the class of work for which they are intended. The enamel is applied to the eyelets in bulk by a process known as the air drying and baking process. The apparatus required for the purpose is a special form of tumbling barrel and the medium is a special kind of black Japan. By this means the individual eyelets are covered with a very thin layer of enamel, and by constant tumbling in the shaking barrel the separate parts are not allowed to stick to one another. The top surface being polished previously imparts a bright lustre when blackened.

For imparting brown or any other colour, enamels of suitable type is applied to the eyelets in the same way as the black Japan.

Brass Toys and Idols.

From the countless varieties of brass articles which are produced by casting, there is always some varied form and unique feature that taxes the ingenuitly and skill of the mould maker to turn out the work satisfactorily.

The brass toys and idols ore principally manufectured at Benares Mathura, Agra, etc. and are made of two different varieties—solid and hollow. In manufecturing solid articles, a model made of wax and resin in indispensable. It is made by hand with so dexterity that the outlines of the face and limbs are marked out very prominently on the finished product. The model prepared is next incased in a mould, built of clay. Before running in the molten metal into the mould, the mould is heated, thereby causing the wax mixture to ooze out of a hole left for that purpose. The metal, which is melted in a furnace in the meantime, is run into the cavity thus formed and the whole is set aside to cool. When cold the mould is broken up and the casting taken out and polished in the usual way.

In making hollow idols a clay core is first finished in the shape of the figure. This is then coated with a layer of the wax mixture ; an outer shell of clay is plastered on. The wax is melted out and the resulting cavity filled with molten brass. When cold the outer mould is broken up and the inner core is extracted by breaking up the burnt clay inside with a long nail. The hollow inside is then filled with lead and finally a small brass cap is put into the hole at the top of the image.

In producing cheap objects metallic moulds are general ly used. A copper pattern made in two vertical halves,

serves the purpose well. These are constructed in such a manner that the pieces are kept together by four small friction clutches. Before introducing the molten metal into its cavity, it is besmeared with oil or grease so that the metal will not cling into the mould.

After casting the rough surface of the work is submitted to the cleaning and polishing process.

Copperwares.

Copper utensils are generally manufectured from sheet copper. There are several processes, of which the following are more or less adopted.

In *one* the raw meterial is simply beaten into shape. Plates, *thalis*, cooking and water pots and saucers are chiefly made in this manner. They are, of course cheap. In the *second method* the raw meterial, after being cut up into blocks about 8 inches, square, is made red-hot in a charcoal furnace, and these blocks are welded together by beating on an anvil, the metal being thus thickened and gradually worked into shape. The large kind of water pots, and also many of the smaller *lotas* are worked in this manner. In the *third method* the vessels are prepared in two parts and subsequently soldered together in the centre. Cooking utensils and other vessels made in this manner are dearer than those prepared by the first method, but they are more in demand, as they are more enduring. As this method is far more important than the other two processes which have already been discussed under the caption of Making of Brasswares we shall only treat this last method for the present.

In this process vessels in daily use are usually made by a combination of the casting and beating process, i. e, one part of the vessel is beaten and another cast and then the two parts are soldered together to form the whole. All

that has been said above as to the diversity in manufacture of beaten vessels applies equally to that of composite vessels. How is it possible to combine the two main processes—this is the object for us to discuss here.

On a sheet of copper two circles are described with the compass and cut out by means of a chisel. The two discs are then placed over a block of stone, with a deep circular dip cut in it. Into this dip the discs are beaten with a heavy wooden mallet ; under this hammering they gradually assume the shape of a basin and thus form the upper and lower halves of the utensil. A hole is then cut in the upper half, for the insertion of the mouthpiece. This mouthpiece is made separately from a cast copper plate. It is beaten from the centre outwards, with s chisel and hammer. From time to time, in the course of the beating, it is heated over an open furnace to render the copper more malleable. When completed, it is soldered into the hole made for it in the upper half of the vessel. All that now remains to be done is to join the upper and lower halves. The edges are dove-tailed and beaten together and soldered with a special kind of solder. which is composed of copper, 4 parts and pewter, 5 parts. This makes a very strong fastening and enables the vessel to withstand the wear and tear during rough usage. Lastly the vessels in domestic use are coated with tin, the process of which is described below, to avoid risk of poisonous accretions.

Tinning Copper.

The articles of copper, especially the cooking utensils which are to be tinned for the first time are boiled in a solution of alum, verdigris, sulphate of copper and sal ammoniac. On subsequent occasions they are simply coated with tin without any previous preparation except that of removing the old coatings. In the process of tinning,

tin is first of all reduced to powder and then mixed with sal-am-moniac and lastly, applied by means of a piece of cotton, the article being heated on a charcoal fire. It is then polished with sand and ashes.

Ornamental Copperware.

In the manufacture of ornamental copper wares, the designs are usually chased or punched away on the copper vessels which are already tinned, thus leaving the ornamentation in relief. The excavations thus produced are then loaded with black or variously coloured lac, applied by hot bolt, which fuses and distributes the lac over the surface. The excess smeared beyond the design is rubbed off with sand paper or powdered brick. The surface is next polished, and the pattern thus appears in colours within the metallic surface. Sometimes these tinned copper vessels are simply chased, when a red pattern shows through the white metal surface.

Artistic copper wares can also be produced by adopting the following process. Wood is first carved, then over the surface are placed thin plates of tinned copper. These are hammered on to the wood and are then securely fixed by pins and retained over the surface of the wood, thus producing a sort of repouse.

Bell-Metal.

The bell-metal industry is mainly carried out in India. It is one of the few village industries which have not yet suffered from the competition with cheap machine made articles imported from abroad. In spite of extensive demand for aluminium and enamelled wares, the industry still continues to thrive in its important centres, because the average Indian house-holder still prefers the utensils made of this alloy.

Bell metal of superior quality is an alloy composed of 4 parts of copper and 1 of tin. The characteristic feature of this alloy is that it is not affected by acids. For this reason domestic utensils made of it are much prized. Owing to the high polish which it will take, this alloy is also largely employed in the manufacture of ornaments worn by the poorer section of the people of northern India.

Two methods are generally adopted for the manufacture of bell-metal utensils viz., (1) the hammering process and (2) the casting of the alloy in moulds. Of these two processes the former is mostly employed owing to the belief that the articles made by this process are much more durable than articles cast in moulds.

Hammering Process.

In the hammering process the requisite mixture of the ingredients or old bell-metals are put into the earthen crucibles, made of blue earth mixed with cowdung, lime-stone, grain husks, and jute cuttings. The crucibles are then introduced into the furnace being covered with two semi-circular earthen dishes and kept there for several hours. They are then taken out and the molten liquid comes out of the crucible through a hole made in it into small earthen cups to form ingots. Oil is placed on their bottom, and when the liquid has been poured, grain husks are burnt on its surface. The burning of the carbon reduces the scum and prevents any free metal to oxidise. The scum is then skilfully removed and then allowed to cool.

The next process is to beat out these ingots. For this purpose these are heated in a special type of furnace, in which no forced draught is used. When they are red hot, they are taken out from the furnace and are beaten out into sheets with a hammer. The process is sometimes

repeated until the sheets of 1/10th of an inch is obtained. At this stage, discs and rings are marked out on them with compasses according to the size and dimensions of vessels to the made. The pieces so marked out are cut and separated from the sheet with a pair of clippers and are then hammered with a mallet on a stone anvil until each piece assumes the required shape. If the vessel is to be composed of several sections the pieces are first hammered into corresponding shape when these are exactly fitted together. Afterwards they have been heated and joined with solder, the composition of which is 3 parts of brass and 1 part of zinc. When cool, a file is used to polish the joints.

Lastly, the vessel is scraped clean with a chisel and polished in hand lathe.

Casting Process.

The casting process naturally falls into two sub-divisions, moulding and casting proper. Hollow moulds of the desired shape of the article to be moulded are generally required for the purpose. These are made of a mixture of clay, cowdung, limestone, grain husks and jute cuttings. Great care is taken in making this mixture. The clay free from coarse particles is mixed with the other ingredients and properly kneaded. The mould is fashioned by hand and is not baked over fire, but dried in the sun, and when dry is turned on a hand lathe.

At one end of the shaft a lump of lac or of rosin is attached. The bottom of the dry mould is heated and then applied to this lump of lac or rosin, so that the lac or rosin softens and the mould adheres to it. When the mould cools down and lac or rosin hardens, the two are found strongly united. The mould is then turned on the lathe, and a chisel is applied to the mould to make it symmetrical

and to cut the rings on it which the vessel should have. When this is completed, the chisel is gently inserted between the bottom of the mould and the lump of lac and the mould is separated from the lathe. Then the mould is plastered over with wax or rather with a mixture of 2 parts of wax, 16 of rosin and 5 of sweet oil. The coating of wax is made of the thickness of the intended vessel. Over the layer of wax a coating of clay is put. To give fixity to the apparatus three small nails are driven at the bottom through the three coatings.

The next step is to take the crucible. which has got its charge of metal and has been covered with clay, and to make a small hole near the edge of its cover. A spout of wax covered with clay is attached to both the mould and the crucible so as to connect the interior of the crucible with the space in the mould between the two layers of clay. Then the mould and the crucible are incorporated into one mass by thickly coating the whole exposed surface of the two with clay. The mass (with the crucible below and the mould on the top) is dried in the sun. It is placed in the same position in the furnace.

In casting the moulds and crucibles are kept at a bright red heat for about 5 or 6 hours during which time the metal is fused properly. At this stage the moulds and crucibles are inverted so that the metal runs down from the crucible to fill the cavity of the moulds. During this time the moulds are generally tapped to insure a perfect permeation of the fluid metal. The moulds are then set for 6 or 7 hours to cool. Any undue haste in breaking up the mould before the metal had set would spoil the casting.

When the mass is cooled down the clay is broken off, both inside and out-side with a chisel. This must be done

very carefully otherwise there is a risk of cracking the vessel. The work is lastly turned on the lathe and a file is applied to smooth and clean it.

Defective Casting and How to Repair.

It is a by no means uncommon occurrence to find, when the mould is broken up, that the casting is defective. For instance, the metal may not have properly permeated the mould, or holes may be caused by the gas not having been able to escape properly as the metal was run in. Flaws are also caused by too rapid cooling. It has been calculated that nearly 25 per cent. of the castings are usually found defective.

Should the flaw be very great there is nothing for it but to melt down the vessel and recast it. But when the flaw is slight the defect is repaired. This can be done by laying on a patch cut from a new sheet of the same metal. The process of mending will, of course, vary according as the vessel is one of pure brass or of alloy. In the former case four teeth are made in the patch to grip the edge of the hole in the vessel, and the patch is then beaten on with a mallet. In the latter case the edges of the patch and the hole in the vessel are filed until they are even and fit properly, when they are soldered together. The solder is composed of pewter and copper, ground into powder, and made into a paste. In the case of small holes, it is sufficient merely to fill them with this substance without putting a patch.

Improved Method.

While the ignorant bell-metal workers of our country have continued the processes and the constituents of the alloy handed down to them by their forefathers, metallurgical science in the non-ferrous alloys has made astonishing progress in the western countries and elsewhere as the

result of scientific research. It has been the purpose of the Department under the Director of Industries, Bengal to apply this valuable knowledge and developments to the old fashioned industries in this country.

One of the most striking developments in this connexion has been made in the matter of producing bell-metal articles with all the qualities required to be associated with them, but using different constituent metals in the alloy, which are cheaper in first cost. This is done by replacing the expensive tin with a certain proportion of zinc and by using a trace of aluminium when melting the alloy in the crucible. Results are obtained which show a marked economic improvement on the methods prevalent in the ordinary bazar.

In the first place the cost of the constituent metals is cheaper by 35 per cent, than the old fashioned formula using copper and tin only. Secondly, an article of the same quality is produced which, because of its constituents, is 6 per cent. lighter, even though the articles are of the same size and thickness as the bazar made articles. Lastly, the fluidity of alloy at normal moulding temperature is so greatly improved that homogeneous condition of the resulting casting gives better consistent results than are obtained in ordinary practice.

From numerous experiments which have been made in the Industrial Research Laboratory, Bengal and which are now being demonstrated in different parts of the province, it has been shown that equally satisfactory articles to those made in the bazar can be produced at 50 per cent. less cost and with less wastage than is usually the case simply through the use of an alloy whose constituents have been based on modern non-ferrous metal research. (Industry)

Trunks, Boxes etc.

Trunks, Boxes, suitcases, despatch boxes, cash books, trays, waste paper baskets, letter boxes, tubs, flour bins, *hamams*, C. I. sheet pipes, saucepans, kettles, oil cans, watering cans, paste cutters, lamps and lanterns and such other articles are in great daily use by Indians. This is one of the most suitable lines for educated youths. It requires a very little capital for a start and a few tools for the workshop such as hammers, stakes, wooden mallets, punches, groovers, rollers, cutters, stoves etc., etc. Machineries required are for grooving, penning, etc.

The demand for such articles is daily on the increase. Any one getting a short apprenticeship training can make a start in this industry. In large towns manufacture of new articles according to new designs, serviceable to the people, would pay. A handsome business can be done in introducing flour cans, cereal cans, seed cans etc., in villages where there is a great demand for such articles on account of loss through rats.

There is no house in India, which do not use dozen of varieties of articles made of iron such as *tawas*, *chimtas*, *bili*, *karhai*, *angithi*, *balti*, *choolahs*, *lotas*, *trakri*, *hookas*, etc., etc. They are usually manufactured in India by blacksmiths, *lohars* and sold by *kasairas*. Such articles can be profitably manufactured and trade in the same carried on by the educated youths.

Scientific and Sanitory Goods.

Manufacture of scientific apparatuses for laboratories, schools, colleges, chemical and scientific concerns, etc., is being carried on by some institutes just like Punjab Scientific Instruments Workshop, Lahore. There are hundreds kinds of instruments required in laboratories

hospitals etc. and there is a big margin for their manufacture in this country. It is undoubtedly a trade most suited to educated youths.

Even repairs of scientific instruments is a great industry by itself and it is at present one of the most paying lines for the educated youths. An instrument weighing a few tolas or chhatak of iron, may cost tens of rupees and an ordinary repair may yield many rupees. But this is a most skilled industry and cannot be carried out unless one acquires good experience in some progressive factory.

With the rise of civilisation and standard of living in our country the demand for sanitory goods is fast increasing and there is a big field in manufacturing and trading in sanitory goods. Such firms are being established in all big towns of the country.

Cutlery.

India was very famous for its cutlery a few centuries back. To-day, though it meets its cutlery demand to a great extent by itself, yet it has to import thousands of rupees worth fine cutlery from abroad. Times are gone when rude cutlery could serve the purpose. To-day the demand is for higher class of cutlery. Surgical instruments, shaving razors, knives, scissors, forkes, sacrificial knives, daggers, *kirpans*, nutcrackers, *sipari* cutters, etc., are of common use. It is pleasing to note that they are being manufactured in India. But their output is poor and insufficient and it yet offers field of work for hundreds of educated and trained youths, to meet all the demand of the country in cutlery. A capital of Rs. 10,000/- is required to set up a decent modern cutlery factory.

Barbed Wire.

M/s Madan Engineering Works Ry. Road, Lahore, writes :—

Barbed wire is made of galvanised wire and has in some cases two points and sometimes 4 points at various distances.

The machines of which we give an estimate below will make about 450 lbs. of wire per hour and can be worked with electricity or steam. Power required only 5 B. H. P.

An automatic machine with complete set of tools for making 2 and 4 point barbed wire will cost about (C. I. F. Indian Port). Rs. 6000

An automatic measuring and stop motion apparatus and others necessary appliances will cost about Rs. 1500

Rs. 7500

Bicycle and Motor Bicycle Spokes.

Spokes consist of a spoke proper and nipple to keep it fastened with the rim of the wheel. More than one operation are required to complete a spoke and the nipple. If they are made on small machines the spoke alone will require not less than 3 machine to finish it. We however quote below for a larger machine which makes a spoke in a single operation.

One automatic machine for making a spoke complete with bent head and threads of ordinary thickness and length and capable of making about 70 spokes per minute. Price C. I. F. Indian Port about Rs. 10500.

One automatic machine will be required to finish. Price C. I. F. Indian Port about Rs. 9100.

The whole plant will require about 5 B. H. P. to work it.

Nuts for Bolts.

Nuts are of various sizes and designs, some with round square or hexagonal head.

We give below an estimate for machines for making hexagonal and square headed nuts 3/16″ to ½′ inner diameter (viz. diameter of threads). The price of a machine for making medium sized nuts viz from 5/16″ to 3/8″ diameter will be about Rs. 12000 F. O. R. German Port. Nuts will be made cold without beating.

Miscellaneous.

There are miscellaneous other articles that can be profitably manufactured in India such as umbrellas, machines for various industries and labour saving devices, parts and accessories for railways, motors, machineries etc.

Training Institutes.

Bengal Engineering College Workshop, Sibpur.
B. P. Khatri Industrial School, Benares.
C. Technical Institute, Mysore (Cast, Turned and Sheet Metal Work).
Dayanand Industrial School, Lahore.
Dyalbagh Technical Institute, Agra.
D. B. Tech. School, Burdwan.
Friends Industrial Works, Hoshangabad.
Govt. Tehnical School, Insein.
Govt. Metal Working Institutes at Aligarh, Ambala and Sialkot.
Govt. Trades School, Trichur.
Industrial School, Aurangabad.
Jaysinghrao Technical School, Kolhapur.

Mayo School of Arts, Lahore.
School of Arts and Crafts, Madras and Lucknow.
School of Arts, Jaipur.
Technical School, Jacobabad.
V. J. Technical School, Poona.
Welsley Industrial School, Benares.

Training can be had as an apprentice in any local foundry or any workshop carrying the trade.

Bolt and Nut Making Machinery Manufacturers.

Acme Machinery Co., 4533, St. Clairavenue, Cleveland, (U. S. A).
National Machinery Co., Tifiin, O. (U. S. A.)
Universal Machine Co., Bowling Green O. (U. S. A.

Chain Making Machinery.

Coulter and Mackenzie Machine Co., Bridgeport, Conn. U. S. A.
A. H. Nilson Machine Co., Bridgeport Conn. U. S. A.

Cutlery Making Machine.

W. Bucher and Co., Feldstr, 20, Solingen-grafrath.
Th. Kierserling and Albrecht. Machinenfabrik, Solingen. (Germany).

Foundry Machinery.

Badische Maschivenfdbrile U. Exsengiesserei Durlach Baden, (Germany).

Metal Working Machinery.

Bardly and Craven Ltd., Wakefield (England).
Danial Smith & Co., Castle Iron Works, Raglan Street, Wolverhamption. (England).
J. H. Leber, Kingsbury Engineering Woks, Kingsbury Road Balls Pond, London N.

Remus Co., Ltd., 30, 32 and 34, Tubervacle Street, London E. C.

Steinle Turret Machine Co., Madison, Wis, U. S. A.

Moulding Machinery.

Berkshire Manufacture Co., 1101 Power Ave. Cleveland, O. (U. S. A.)

International Moulding Machine, Co., 2614 W. 16th Chicago. U. S. A.

Nail Making Machinery.

Even and Mittan, Smithfield works, Sherlock Street, Birmingham.

Oliver and Co., Clonteriedu Phonix, Orlean, (France).

Needle Making Machinery.

F. B. Shuster and Co., New Haven, Cont., U. S. A.

Nib Making Machinery.

Kshettra Nath Dutt, 4, Parvatti Charn Datt's Street, Calcutta.

Shama Chander Ghose, Kartwa, District Burdwan.

Tambat Brothers, Kurla, near Gwalior.

Plate Die and Printing Press.

Taylor Challen Ltd., Constitution Hill, Birmingham.

Waite and Saville Ltd., Ottey Works, (England).

Punching Press.

Zander and Opity, 76, Sebastimatre, Berlin (Germany).

Stamping Machinery.

Blake and Johnson Co., Waterbury Conn. U. S. A

E. W. Bliss Co., Brooklyn, U. S. A.

National Machinery Co Tiffin, Ohio U. S.

Wire Covering Machine.

Ernest Lebmann, Manchester.
H. H. Well, Youkes. N. Y. (U. S. A.)
Chase Machine Co., Cleveland, Ohio. (U. S. A.)

Wire Drawing Machines.

Jones, Geo, Ltd. Birmingham.
Blake and Johnson Waterbury Conn. (U. S. A.)

Wire Nail Machine.

Blake and Johnson, Waterbury Conn. (U. S. A.)

Books.

Adams H. M.—Metal Work 6 sh. 6 d.
Atkins E. A.—Practical Sheet and Plate Metal Work 7 sh. 6 d.
Barrows F. W— Pattern Making 12 sh. 6 d.
Bell.—Monograph on Iron and Steel Work in Burma.
Bell W.—Moulding and Foundry Work. 3 sh. 6 d.
Broemel, L.—Steel Metal Works Manual.
Brannt.—Metal Workers Handy Book of Receips and Processes.
Clements F.—Blast Furnace Practice 63 sh.
Hart G. H.—Metal Work.
Hasluck P. W. Tinplate Work.
Horner J. G.—Modern Iron Foundry.
Longfield E. M.—Steel-Metal Drafting.
Monyhenny.—Stainless Iron and Steel.
Monograph on the Iron and Steel Work in Eastern Bengal and Assam.
Needham W. R.—Pattern Making.
Palmer R. H—Foundry Practice.
Rawlinson—Modern Foundery Operations and Equipment.

Saunders B—Forging, Stamping.

Scudamore.—Monograph on Iron and Steel Work in the Bombay Presidency.

Watson.—Monograph on Iron and Steel Work in Bengal.

Worsley.—Monograph on the Iron and Steel Industries in the Punjab.

Journals.

American Mechanist, New York.

Foundry Trade Journal, London W. C. 2.

Iron Age, New York.

Journal of the Institute of Metals, London S. W. 1.

Journal of the Iron and Steel Institute, London S.W. 1.

Metal Industry, London W. C. 2.

Metal Industry, New York.

Sheet Metal Industries, London W. C. 1.

Steel Metal, New York.

Printing.

Printing is the carrier of education. It is the chariot for civilisation. Bereft of the wings of printing the civilisation cannot fly beyond its narrow region. It has revolutionised every human activity in religion, politics, education, geography etc. Printing was discovered only in 1440, prior to which writing work was confined to hand writing only. Since then it made slow advance, but for the last half century it made amazing strides. In India it got birth with the advent of British rule. The first newspaper was started in India in January 1780. To-day there are over 10,000 printing presses in this country and about 2,000 newspapers and 4,000 periodicals. They employ in their various trades lacs of people. As education is undoubtedly progressing and as journalism is yet in its infancy in this country and is marching forward, more printing presses will be started and thus offer employment to a large number of people. It is an essential industry and slightly effected by the seasons of the year.

Printing may be divided into three processes— tpography, copperplate and lithography. Typography is the common process of printing. In this process printing is done with raised letters. Such tvpes are moulded in foundries and are available in the market. They are composed into matter for printing either by hand by compositors or by machines known as linotype and monotype, which run on the key-board principle like a typewriter. English, Hindi, Sanskrit, Bengali, Marhatti, Gujrati, Pali, etc., printing work is done by typography. In copperplate, letter is sunk, the centre being filled with ink. This is the method adopted for printing block work, pictorial work and work of diagrams

nature. All illustration is done through this process. Lithography print is done by using the surface of the stone, which is capable of absorbing grease. All Urdu and Persian work is done through this process. This is also used for illustration work, the coloured poster work, etc.

The machines used are of three kinds:—platen, cylinder and rotary. The first is the smallest and easiest to work at. But it is used for job printing work and each paper is to be removed after one impression. In the cylinder press, the paper is revolved on a roller and the mechanism is so made that paper is put up for impression and removed after the print itself. In larger press prints, paper is printed, gathered, folded, cut, counted, stacked and packed in packages of 50 or over, all simultaneously and automatically to the extent of 50,000 papers per hour, by use of rotary machines.

Printing is a creative trade. It is one of the best paying trades. In America it was exceeded by the buildings trades only in wages,whereas it ranked higher than the automobile, the clothing, the steel and other such industries. It is primarily an industry of small establishments. It is yet in its infancy in this country and best suited for educated youths. India yet requires better presses and better printing work. In fact book printing in India is not being satisfactorily done here on large scale. Many Indian publications are being printed in foreign countries. So the chances are great for the youngman, having high education, good health, eyesight, a business acumen, alertness and an artistic or creative instinct. Book binding, block making, etching, book illustrating, and book publishing are some of allied trades.

Presses specialise in various works—some do job printing as visiting cards, invitation cards, letterheads, cards and announcements, leaflets, etc. Such a press can be

planted with a capital of about Rs. 3,000 only. Others handle bookprinting work. Such a plant can be arranged with a capital of Rs. 7,000 to Rs. 10,000. Bigger plants for newspaper printing are not within the jurisdiction of our discussion. Presses can be worked by hand or by electric.

In the words of Mr. S. H. Rau :—

Printing is said to be a semi-manufacturing business, and combines the big profits of the manufacturer and the case of the small retail shop keeper. Started on the lines here suggested, printing can be made to produe a greater percentage of profits on the investment than any other business with the same capital. It can be started in a small town as well as in a big city as a very big circle of customers can be built up even in the mofussil.

A small room is more than enough for the business, with a screen dividing the " works ', portion from the front, which may be made a sales room for receiving customers. Very little noise is produced by the machine.

Types and other accessories required are very few. A font of script types for visiting cards ; a set of Spartan types in eight sizes, cast on two bodies, 6-Pt. and 12-Pt.; and a font each of three sizes, 12-Pt., 10-Ft., and 8-Pt., of body types, other than the regular Roman or Old Style ; and the necessary spacing material will do in the way of types. One font of cut pieces of double medium Brass Rule, a dozen or two of $1\frac{1}{2}$ Pt. Brass Rule plain, and a couple of fonts of borders complete the equipment.

Specialization should be the keynote of the business of the small printer. He could very profitably concentrate on Letterheads, Envelopes, Visiting Cards, Business Cards, Lables etc., which can be more economically done on this machine than on bigger machines. Every one of these jobs

as a rule comes within the small printer's equipment and fetches a good price. Billheads can also be added, with a stock of different sizes of ready ruled forms, to be printed and supplied to the customers. Quantity orders for bill books should not be undertaken, (as for example, 500-bill books, with triplicate leaves, printed, perforated, numbered and bound,) though the size of the machine. They are to be handled by the big printer who has the facility to set the job four or eight times and thus reduce the number of impressions. It is profitable to do more jobs of small runs each, than a job running into several thousands of copies.

A paper-cutting machine, however strongly recommended, should not be purchased by the printer who wishes to run the business on this scale. It may sound strange, but it is the voice of experience. Unless the printer can afford to have a bindery that can keep the cutting machine in use all the time, the investment on it will eat up all the profits earned, and the printer is likely to get disheartened. The need of a cutting machine is obviated by an intelligent arrangement to require no cutting or trimming after a job is printed. Standardization helps the printer to achieve this end. He could stock paper in the different sizes required within his capacity, and also ruled billheads. The only other goods that are to be stocked are, post cards, white and coloured, envelopes in varieties and sizes, visiting and business cards. Illustrated blotters and brodered blanks issued by high class lithographers and engravers like Messrs. Garrett and Atkinson, London, may be stocked with advantage,

The staff to be employed to begin with is one compositor-machine man, and when the business is well established, a man can be engaged exclusively for the machine. The proprietor himself is supposed to receive money, attend to customers and keep accounts.

Organising the selling end of the business should not be neglected simply because the business is small. A decent port folio containing good specimens of printing works done should be had ready to show prospective customers for canvassing purposes. A quarto size book, made of thick paper or manilla card, preferably of some dark colour, could be made and samples pasted on the pages. Even standardized prices may be marked on the samples, though this is usually unnecessary. The level of prices should never be allowed to fall far below that of the regular market. Though it costs less to print jobs with this equipment than with costlier ones, the advantage should be kept for the small printer himself and should not be passed on to the customer.

Seasonal business could be done in the line of calendars and show cards once a year. By planning ahead to procure suitable calendar backs and date-pads from big manufacturers, the last two or three months of the year can be made very profitable and busy, in supplying customers calendars with their names and addresses printed. It sometimes pays to have some connection between the special offer and the season, as for example, offering to print free of cost a small picture of Ganpati on all notepapers and envelopes ordered in the Ganpati season.

The enterprising printer will create seasons for his business rather than wait for nature's divisions of the year. After having built up a circle of customers, the printer can announce specialities of certain lines for certain months, like " Letter heads month." All orders for letter papers received within that month will be executed at a certain lower rate than at other times of the year. He could previously prepare for the season by stocking bank paper cut ready to the different sizes usually required, and also certain

standard makes of note papers like, the Silver Cross. Arrangements could also be made with the local stationer that all purchase of notepaper made in that month should be considered a single purchase and a decent discount allowed.

The printer has one valuable advantage over other traders : most of his customers are themselves businessmen who understand the vicissitudes of business, and who do not ask, when properly approached, for drastic cuts in prices and who may be depended on for correct payments. One of the greatest pitfalls of the businessmen is thus avoided viz., bad debts.

While starting business, a certain amount of trouble and expense is necessary for advertising it. Another useful device for building up a big mailing list all over the country is to use the waste space on other businessman's stationery, like the back of envelopes, to carry a message like this : "Free Printing for Businessmen—We offer to print your name and address free on the front of the envelopes, if you let me print this advertisement on the back." Considering that each such business house forms a centre from which these advertising envelopes reach out to a circle of customers, the possiblities of quickly building up a clientele are great. Short advertisements both in the classified columns and in the display pages of newspapers and magazines may be used. At least two inches space, with an attractive specially engraved block is to be preferred for the display advertisement, rather than mere typesetting. A few journals offer to print a short classified advertisement free of cost, if space is contracted for display advertisement.

The printer will soon be confronted with the problem of increasing his equipment. As soon as a circle of steady

customers is made, and when a definite account of business is regularly obtained, the temptation to increase the business is naturally great. But the secret of success of the small printer consists in his ability to resist this temptation and refrain from buying costlier equipment.

Estimates for a Press for Job Work:—

One 10×15 Machine worked by treadle or power—	
American	1500/-
or	
German	1300/-
3 sizes Romans with Italics and Antiques	350/-
50 Kinds of latest Job Types including Rules, Borders, Cases, Racks etc., etc.	650/-
	Rs. 2300/- or 2500/-

NOTE:—The above size (10×15) of the machine is the most suitable one for every sort of Job work.

If one desires to invest a little less amount he may go in for a rebuilt or smaller size (8×12) Machine.

Similarly if one desires to print Journals mostly he can go in for a particular size of the machine, of course the price will go as the sizes go and more type (Roman) will also be required which also means adding to the said amount.

For Book Work (English only).

One Treadle (small size)	1300/-
One Treadle (big size)	2500/-
One Proof Press, big sized with inking arrangement.	500/-
Roman or old style type with Italics	3000/-
8, 10, 11 and 12 Pt. Mathemetical, Astronomical, Economical signs, Medical signs	

Accents, Fractions, Split Fractions, Superior, Inferior figures and letters, Cancelled and dotted figures and Accents.	1000/-
6, 8, 10, 11, 12, 16, 18 and 24, pt. Antiques etc.	1000/-
Wooden furnitures, Rules, Racks, Galleys, Cases, Sticks etc., etc.	500/-
Miscellaneous	200/-
	10,000/-

The machines may be increased if the work is more or the sizes may be varied according to the work one receives.

For printing Hindi Books only Hindi type may be added to the above quantity and types and separate Hindi cases are the only article required.

For printing Urdu Book work types only are the additional requirement but for printing in Litho separate Litho machines are required which if purchased a new requires an equally big sum as the type cylinders and then there are stones required or zinc sheets required which mean additional cost. For a small book printer the cost may be still reduced.

Tin sheet and hollow ware printing.

There is a very large number of printing presses in the province but none of them is equipped for printing on tin or metal sheeting. Printed tin sheet is in great demand for various purposes such as small sign boards, placards, containers for articles of food, toilet requisites, cigarettes and various other articles for daily utility which are sold packed in tins. One or two factories have been started in the industrially advanced province of Bengal to meet this demand

and it is time that a similar factory were started in every province. The cost of the plant varies with its size, but a small plant consisting of one offset tin printing press with an impression surface of 32″ complete with automatic roller, cleaning device and semi-automatic pile feeder will cost about Rs. 15,000/-. It will be necessary to instal with this tin plate varnishing and quoting machine which will cost another Rs. 6,000/-.

Estimate for an uptodate Book-binding Factory.

One 40″ Guillotine Cutting Machine—Automatic with device for cutting small labels	500/-
One 18″ Book Backing Machine made by Preusse and Co.	1200/-
One Book Thread Stitching Machine by Preusse and Co.	1200/-
One Book Rounding Machine 16″ by Mansfold.	1200/-
One 12 M. M. Wire Stitching Machine for hand and treadle.	420/-
One Corner Rounding Machine by Krause with various punches.	420/-
Two 6 Wheels Numbering Machines with Duplicate, Triplicate, Quadruple and consecutive actions.	80/-
10 Sets Brass Types.	500/-
One 32″ Perforating Machine.	500/-
	Rs. 12000/-

But to start with one cutting machine valuing Rs. 2000/- is quite enough.

Printing Machinery and Supplies Dealers.

Asiatic Machinery Stores Co., Hornby Road, Bombay.

Accents, Fractions, Split Fractions, Superior, Inferior figures and letters, Cancelled and dotted figures and Accents.	1000/-
6, 8, 10, 11, 12, 16, 18 and 24, pt. Antiques etc.	1000/-
Wooden furnitures, Rules, Racks, Galleys, Cases, Sticks etc., etc.	500/-
Miscellaneous	200/-
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	Rs. 12000/-

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Printing Machinery and Supplies Dealers.

Asiatic Machinery Stores Co., Hornby Road, Bombay.

Dickinson John and Co., Ltd., Fort Bombay, Calcutta and Madras.

Indo-European Machinary Mart, Lahore, Bombay, Delhi and Lahore.

Linotype and Machinery Ltd., Calcutta.

Oriential Type Foundry, Chitpur Road, Calcutta.

Richardson Printing Ink Co. Ltd., Howrah.

Standard Type Foundry, Lahore and Amritsar.

Training Institutions.

Government School of Technology, Madras (Type casting, stereo typing, electrotyping, machine work, composing, proofreading, printing, book binding, printers warehouse work, etc. It prepares for the examination held by City and Guilds of London Institute in England).

Government Trades School, Madras.

Government Printing Presses at Lahore, Calcutta, Cawnpore, Madras, and Bombay.

Government Printing Technical School, Patna.

R. T. L. C. N. C. Technical Institute, Vepery, Madras.

Indian School of Arts, Calcutta.

Technical Institute of India, Delhi.

Training can be arranged as unpaid apprentice practically in every local press.

Books.

Atkins, W—Art and Practice of Printing (Six Volumes (Pitman). £ 2/5

Hague, C. W.—Printing Occupations.

Henry, F.—Printing for School and Shop.

Salade, R. F.—Handbook of Electrotyping and Stereotyping.

Shaw, F. L.—Printing Trades.

Southward, J.—Modern Printing.

Journals.

American Printer, New York.
British Printer, London W C 2
Inland Printer, Chicago.
Modern Lithographer, London W C 1
National Lithographer, New York.
Printers Register, London E C 4.

Sand Paper Manufacture.

Abrasive (glass and emery) paper commonly known in this country as sand paper is mostly used in industries of iron, steel and wood.

There is not a single factory manufacturing this paper in India. A plant for the manufacture of this paper is a necessity. Specifications for a complete plant with an output of about 18,000 sheets of 12″×9″ in a day of 8 hours is given below.

Process of Manufacture.

In an automatic apparatus the cloth or paper reel is first printed on the back with the trade marks and the number of emery or sand to be used. The reel then travels through the gluing machine where glue is spread uniformly by means of stationary and jiggering brushes. Then the glue coated reel travels through a strewing machine where the emery or glass compound are spread over the glue. It then passes through drying boxes where it is dried by suitable heating and ventilating units. From there it passes through slitting and cross cutting machines where the reel is cut immediately into standard sizes.

Machinery required:—

One printing machine used for printing the name and address of the firm on the back of the paper. (This however may be omitted if it is not desired to print on the back)	Rs. 714/-
One gluing machine	Rs. 2054/8/-

One pneumatic pulling apparatus with endless folt hose and exhauster	Rs.	294/-
One cooling table with blowing fan, transporting chains and rods to transport the paper or cloth	Rs.	420/-
One spreading machine for spreading the glass or emery on the paper	Rs.	969/8/-
One iron heating plate for steam heating	Rs.	318/8/-
One second pneumatic pulling apparatus with endless folt hose and exhauser	Rs.	294/-
One hanging up apparatus with 2 turn tables and complete self acting rod arrangment for drawing the paper. (This may be eliminated if it can be arranged to drive the paper otherwise)	Rs.	2317/-
One square cutting machine for cutting the paper into trade lengths. (This can also be elimated if arrangement can be made to cut the paper otherwise)	Rs.	1820/-
One glue boilor for preparing the glue	Rs.	360/-
One press for packing of sheets	Rs.	1137/8/-
Electric motor of 5 H. P. for above	Rs.	500/-
	Rs.	16945/- or Rs. 19,479/-/-

It will be necessary to set up a grinding and sifting plant when it is desired to produce emery and glass powders in the factory. This plant will cost about Rs. 5,000/-.

Building.

Main dimensions of the building will be as follows :—

Length	...	50 feet
Breadth	..	26 feet
Height	..	18 feet

The rough estimated cost of the building with the above dimensions will be about Rs. 5,500/-.

Labour wages.

1 Foreman	@ Rs. 170/-	Rs. 170/-per mensom.	
11 workmen	@ Rs. 30/- per sem	men- each. 330/-	
4 coolies	@ Rs. 15/- each	Rs. 60/-	„
1 clerk	@ Rs. 70/-	Rs. 70/-	„
1 storekeeper	@ Rs. 70/-	Rs. 70/-	„

The Foreman should be an expert in the running of such a plant. Training in the manufacture of sand paper can be given in any Industrial Research Laboratory.

Debit.			*Credit.*
1. Cost of raw material for 18,000 sheets per day of 8 hours.			Sale price of sand papers=
a. Price of 9 reams, 450 lbs. in weight @ -/3/-per lb.	Rs.	84/6/-	Rs. 2/4/- per gross in month ly income=
b. Price of 144 lbs. of glue @ -/4/- per lb	Rs.	36/-/-	Rs. 8,437/8/-
c. Price of 405 lbs. of sand @ -/1/- per lb.	Rs.	25/-/-	
Total per day	Rs.	145/11/-	
Total per month	Rs.	4370/ 10/-	

2.	Labour charges	Rs. 630/-/-	
3.	Cost of motive power	Rs. 180/-/-	
4.	Rent, Rates and Taxes @ 2 p. c. on cost of production	Rs. 150/-/-	
5.	Repairs to plant and machinery	Rs. 150/-/-	
6.	Depreciation to plant at 10 p.c.	Rs. 158/-/-	
7.	Depreciation to building at 2 p.c.	Rs. 9/-/-	
8.	Other charges	Rs. 750/-/-	
	Total	Rs. 6,397/10/-	Rs. 8,437/8/-
	Net profit per month		Rs. 2,039/14/-
	Total running expenses per year		Rs. 76,771/8/-
	Total income per year		Rs. 101,250/-/-
	Profit per year		Rs. 24,479/-/-

This means a return of 31. 9p.c. in the first year.

Manufacture of Emery Papers.

Emery papers can also be prepared like sand papers on the same machines. (Production 18,000 sheets per day of 8 hours).

Economics of the Industry.

	Debit.	*Credit.*
1.	Cost of raw material for 18,000 sheets per day.	Sale price of emery papers @ 4/8/- per

a. Price of 9 reams 540 lbs. in weight @ -/3/- per lb.	Rs.	101/4/-	gross in monthly income = Rs. 16,875/-/-
b. Price of 144 lbs. of glue @ -/4/- per lb	Rs.	36/-/-	
c. Price of 720 lbs. of Emery @ -/4/7 per lb	Rs.	205/-/-	
Total	Rs.	343/-/-	
In total monthly expenses for raw material	Rs.	10,290/-/-	
2. Labour wages per month	Rs.	630/-/-	
3. Cost of motive power	Rs.	180/-/-	
4. Rent, Rates and Taxes @ 2 p.c. on cost of production (per month)	Rs.	206/-/-	
5. Repairs to plant and machinery	Rs.	150/-/-	
6. Depreciation to plant per annum @ 10 p.c.	Rs.	158/-/-	
7. Depreciation to building per annum @ 2 p.c.	Rs.	9/-/-	
8. Other charges	Rs.	1,500/-/-	
	Rs.	13,123/-/-	Rs. 16,875/-/-
Not profit per month	Rs.	3,475/-/-	
Total running expenses per year	Rs.	157,476/-/-	
Total income per year	Rs.	202,500/-/-	
Profit per year	Rs.	45,024/-/-	

This means a profit of about 28. 8 p.c. in the first year. (By Industrial Chemist to Punjab Government).

Stationery Goods Manufacture.

Manufacture of Clips.

Paper clip as an article of stationery is in great demand. The manufacture of paper clips is purely a mechanical industry and can easily be taken up by people having a knowledge of mechanical engineering. The Government of India purchases paper clips worth about Rs. 12,000/- per annum. There is not a single factory in the province manufacturing these clips. In the whole of India there is only one factory at Bombay which is producing clips on a modest scale.

Process of Manufacture.

The wire is drawn off a swift, through a set of straightening pegs, and through a tunnel cutting off die, by a cam near the driving pulley, on the left. The wire is cut off to length and immediately two of the slides, in the centre of the machine, descend and bind the wire into the form, round a pair of projecting pegs. The second operation is to bend the left hand and round again, by means of a horizontally moving tool. This side then recedes and another of the vertical tools comes down to make the bend. In the interval, the peg on the left, round which the wire was first bent, has, of course, receded. Another movement of the left horizontal slide produces the formation and a stroke of the corresponding horizontal slide on the right completes the coiling of the clip to the required shape.

In some cases the clip is then considered as being complete, and the pegs, round which it has been formed, recede,

so that it may fall clear. The better class of clips, however, have the end of the first loop bent slightly out of the plane, to give the clip a free lead on the edge of the paper, and this bend is effected by a transversely moving slide in the front of the machine."

Machinery required.

Specifications of the plant capable of producing 175 to 200 clips per minute are given below :—

1	automatic paper clips manufacturing machine ...	Rs. 8,000/-
1	electric motor for running the machine ...	Rs. 150/-
	Total	Rs. 8,150/-
	Duties, Insurance, Freight etc. @. 50% on above ...	Rs. 4,075/-
	Total...	Rs. 12,225/-
	Cost of erection ..	Rs. 225/-
	Total...	Rs. 12,450/-

These machines are American and the price of the dollar has been taken as Rs. 4/-.

Building.

The building for running the factory shall be about 15′ × 25′ Sq. ft. in area and will cost Rs. 2,500/-.

Labour.

1	Expert @ Rs. 80/- ..	Rs. 80/-	per
1	workman @ Rs. 20/- ...	Rs. 20/-	month
1	clerk and storekeeper @ Rs. 35/- ..	Rs. 35/-	,,
2	coolies @ Rs. 12/8/- each ..	Rs. 25/-	,,
	Total...	Rs. 160/-	,,

Economics of the Industry.

	Debit	*Credit.*
1.	Cost of raw material per month. Production of clips per month=2,592,000. 1 lb. of wire for 700 clips-costs -/2/9. Total cost Rs. 636/-. To allow wastage @ 5% aay ..Rs. 668/-	Production per month=2,592,000 clips. Sale price of 1000 clips @ -/12/-: Income per month=Rs. 1,205/-
2.	Labour wages @ a month ...Rs. 160/-	
3.	Cost of motive power month ...Rs. 51/-	
4.	Rents, Rates and Taxes @ 2 p.c. on the cost of production per month ..Rs. 25/-	
5.	Repairs to plant @ a month ..Rs. 50/-	
6.	Depreciation to plant @ 10 p.c. ...Rs. 104/-	
7.	Depreciation to building @ 2 p.c. ...Rs. 4/-	
8.	Other charges ...Rs. 200/-	
	Total ... Rs. 1,262/-	Rs. 1,944/-
	Net profit per month ... Rs. 682/-	

This means that there will be a return of 54 p.c. in the first year on the total investment.

Manufacture of Envelopes.

The Director of Industries, Bombay writes:—

The value of imports of envelopes into India runs into several figures and there are no regular envelope manufacturing factories in this city or the Bombay Presidency, although there are several printing presses and printers who manufacture envelopes by hand which is a laborious method. The essential feature in the manufacture of envelopes is to turn out a clean and neat envelope which is not possible by hand. Further gumming is very unsatisfactory varying in its adhesiveness as regularly as the seasons in the Indian climate, and investors will be more than repaid their trouble if care is exercised in the gumming and manufacture of envelopes.

In this plant which is detailed below, there are all hand or foot worked envelope manufacturing machines of sufficient capacity for a small factory and requiring very little extras as far as foundations and power costs. Several kinds and sizes of envelopes can be made by these envelope manufacturing machines with the use of different sizes of ordinary and adjustable cutters. In order to work out the possibilities of such factory for the manufacture of envelopes it is assumed that the sizes and kinds of envelopes to be manufactured together with output will be as follows :—

Ordinary oblong blue coloured envelopes=$6'' \times 3\frac{1}{2}''$ total quantity 950,000 per month.

Ordinary oblong Buff Manilla large envelopes=$9'' \times 4''$ quantity 20,000 per month.

Ordinary white good quality square envelopes=$6'' \times 5''$ total quantity 30,000 per month.

Machinary Installation.

		Rs.	as	p.
To cost of	1 cutting machine hand worked with two wood blocks including one square wooden cutting block	603	0	0
„	5 only ordinary type of cutting tools.	90	0	0
„	2 only adjustable -do-	317	0	0
To cost of	1 medium size of adjustable envelope machine	1160	0	0
„	1 large size -do-	1220	0	0
„	2 ordinary small size envelope machines.	900	0	0
„	2 -do- large -do-	1220	0	0
„	4 gummers.	312	0	0
„	2 working tables and stools for packing, storing, boxing envelopes.	350	0	0
„	Racks and cupboards for storing paper ream and boxed envelopes.	200	0	0
„	Cupboards, tables, typewriter, etc. telephone connection.	560	0	0
„	Electric light installation.	120	0	0
„	Cement of galvanised sinks for cleaning etc.	30	0	0
	Total cost. Rs.	7,082	0	0
	6% interest and 7% depreciation charges per annum. Rs.	923	0	0
	-do- per month „	60	0	0

Raw materials.

It is proposed to manufacture 3 sizes and qualities of envelopes such as follows :—

Sample 1.	Oblong small envelopes	=	950,000
Sample 2.	-do- large -do-	=	20,000
Sample 3.	Square envelopes.	=	30,000

	Sheets	Rs. as. p.
Sample 1 will be in 2 or 3 colours, green-grey-blue, and will require for 75,000 envelopes paper 30″ × 39. 3/8″ ..	90,000 =	908 0 0
Sample 2 will be in one colour buff and require for 20,000 envelopes paper 24″ × 36½	2,800	42 0 0
Sample 3 will be in one colour (white and not printed) only and will require for 10,000 envelopes paper 30″ × 39. 3/8″	3,000	78 0 0
	96,600	1028 0 0
Add 2 for further waste		20 0 0
		1048 0 0

N. B. In calculating total no. of sheets say Rs. 1100 required for making envelopes, allowance has been made for losses in cutting and handling, packing, etc.

Labour and wages per month.

	Rs. as. p.
6. Operatives for envelope making machines	210 0 0
4. boys for gumming envelops	80 0 0
1. Man for cutting machine and surpervising.	46 0 0
1. Spare man as cooly for carriage of materials.	25 0 0
4. Boys for packing and boxing envelopes.	79 0 0

1/2 wages of proprietors snpervision, clerical work, etc.	60	0	0
Total wages p. m.	499	0	0
say.	500	0	0

Other items of expenditure per month.

To cost of factory rent.	50	0	0
„ Electric lighting.	7	0	0
„ Spares for machinery, knives, etc.	16	0	0
„ Boxing, labelling, banding, envelopes.	365	0	0
„ Insurance on plant and stock etc.	1	8	0
„ Stationery, paper, stamp, etc.	20	0	0
„ Telephone connection.	20	0	0
„ waste, emery cloth, lubricating oil etc.	6	0	0
Total Rs.	485	0	0
say. „	500	0	0

Working capital for 3 months.

To cost of raw materials paper 28/30,000 sheets.	3,300	0	0
„ wages of workman plus wages of owners'	1,500	0	0
„ Other items of expeniture	1,500	0	0
Total Rs.	6,300	0	0

At 6% interest per annum Rs. 378/-/-
per month Ra. 31/-/-

To cost of paper 96,000 sheets for making into envelopes	1,028	0	0
„ wages of workman	500	0	0
„ factory rent	50	0	0

To cost of electric light charges	7	0	0
„ spares, knives, etc.	16	0	0
„ boxing, labelling, banding etc., envelopes.	365	0	0
To cost of stationery, paper, stamps etc.	20	0	0
„ telephone connection	20	0	0
„ waste emery cloth, lubricating oil etc.	6	0	0
„ Insurance on plant and stocks	1	8	0
„ 6% interest charges on machinery and plant and	77	0	0
„ 7% depreciation -do-			
Total	Rs. 2196	0	0
say	Rs. 2200	0	0

Realisation of sales based on the following prices submitted by M. P. Ghandi

				Assumed.		
1st Sample Price of ordinary small oblong envelopes per 1000	Rs.	2	8 0	2	6	0
2d Sample Price of ordinary large oblong envelopes per 1000	„	4	8 0	4	6	0
3rd Sample Price of ordinary square envelopes per 1000 (not printed inside)	„	4	8 0	4	0	0

Income from sales of envelopes,

1st Sample 950,000—Rs.	2256	0	0
2nd Sample 20,000— „	87	8	0
3rd Sample 30,000— „	120	0	0
Total 1,000,000 —	2463	12	0
say	2500	0	0

Taking sales factor as 90% of machine output we get	2250	0	0

To Profit and Loss Account.

To annual returns from sales of 10,800,000 envelopes.	27,000	0	0
„ expenditure for manufacture of 10,800,000 envelopes.	26,400	0	0
	600	0	0

Total income per annum will then be

Net return from sales	600	0	0
6% interest on working capital	360	0	0
„ Plant investment	420	0	0
Total	1380	0	0

Capital investment

Working capital	6060	0	0
Capital investmet on plant	7080	0	0
	13,140	0	0
say	13,200	0	0

Summary.

Capital expenditure	12,200/-	
Net returns as income	600/-	5p.c.
Gross return as income	1,380/-	10p.c.

N. B.—There are no similar types of machinery working in Bombay. The output is, therefore based on the makers' figures given by their local agent. These figures must be guaranteed and the investor will be well-advised to see that this clause is binding with a penalty. Profit

and loss is based on the price per 1000 envelopes submittep from Sind by Mr. M. P. Ghandi and on the outputs and sales factors assumed. It these go lower or higher the profit are affected vice versa.

Marketting.

It may not be out of place to say a few words on the question of marketting envelopes.

It is very essential that goods placed on the market should be as attractive as it is possible to make them. Details of packing, such as lables, boxes, etc. titles, trade names, and distributive labels, (all go to create a favourable impression. Attention to these few points besides the major one of intrinsic good quality is indispensable on the part of the manufacturer who will find himself amply repaid by the growing demand for his goods.

APPENDIX A.

To cost of boxing, banding envelopes etc., packed in boxes of 250 envelopes and in packets of 25s. labelled.	Rs.	as.	p.
500,000 Lithograph or plain printed labels bands for making envelopes into packets of 25.	875	0	0
51,000 Labels for cardboard boxes of 250 envelopes.	127	0	0
50,000 cardboard boxes for containing 250 envelopes.	3150	0	0
220 Balls of banding twine of paper tapes.	52	0	0
2000 Sheets of brown packing paper for sundry work.	36	0	0
120 lbs. of Gum Traganath for gumming together envelope flaps.	135	0	0
Total	4375	0	0
per month	362	2	0
say	365	0	0

APPENDIX B.

Cost and particulars of paper, prices ruling during the 1st part of 1931.

Sample 1. Green, blue or grey paper for making envelopes. Size of sheet 30″×36·3/8″ costs, c. i. f. ... £18 0 0

100 sheets of paper 30″×39·8″ of this quality will weigh 7 lbs.

1 sheet of paper will make 12 envelopes.

1 „ „ „ weigh 1·12 ozs.

Sample 2. Buff colour Manilla paper size 24″×36″. costs, c. i. f. ... £18 10 0

100 sheet of this paper 24″×36″ will weigh 9lbs

1 sheet of paper will make 12 envelopes.

1 „ „ „ „ welgh 1·44 ozs.

Sample 3. White paper size 30″×39.3/8″ costs, c. i. f. ... £28 0 0

100 sheets of this paper 30″×39.3/8″ will weigh weigh 11.50 lbs.

1 sheet of paper will make 9 envelopes.

1 „ „ „ „ weigh 1.74 ozs.

Customs Duty is 20% ad valorem.

Cost of Clearing etc. 1% ad valorem.

NOTE.—Figures of manufacturing costs including those of machinery and raw materials are those ruling in latter half of 1930.

APPENDIX C.

Standard sizes of paper: British Manufacture.

Double Demy	... =	22″×35″
Imperial	... =	22″×30″
Double Crown	... =	20″×27″
Special Royal	... =	20″×27″

Royal	... =	20″×25″
Medium	... =	18″×23″
Demy	=	17″×22″
Large post	... =	16″×21″
Crown	... =	15″×20″
Foolscap	... =	13″×27″

Bombay—Berlin Handelsgesellschafs Dalal and Co., submit the following estimates:—

Envelope Machine with attachment for gumming shaped closing-flaps, type MV, arranged for 2 sizes (beginning and end size) limits of adjustment $3^{3}/_{4} \times 4^{3}/_{4}$ inches to 5 1/8×7 11/16 inches counting apparatus, heating by hot air inclusive exhauster and hot air channel for gas or electricity.

Price ...	... £ 875
Each further size	... £ 35

Output of the machine up to 120 envelopes per minute.

On the machine, quoted for, you can have envelopes only manufactured. Envelopes with side flap will have to be made on special machines, as both kinds cannot be manufactured on one single machine.

Envelope machine with attachment for gumming closing-flaps type BMV, arranged for 2 sizes (beginning and end size) limits of adjustment 3 9/16×$7^{1}/_{2}$ inches to 5 1/8×11 13/16 inches counting apparatus, heating by hot air inclusive exhauster and hot air channel for gas or electricity.

Price ...	... £ 950
Each further size	... £ 45

Output of the machine up to 110 envelopes per minute.

In the event of your wishing to manufacture any further sizes other than suggested by us we shall be obliged if you will kindly let us have your patterns so that we could submit our best suggestion to you.

Stirring apparatus for adhesive substance, type R1
Capacity 50 liters. Price ... £ 50.

The bottles of this machine are covered with brass plates and all parts coming into connection with the adhesive substance are coated with zinc.

Punching Machine Type C.

With automatic release of pressure-piece after each pressure in the highest position, primatio guide for the 4 columns of pressure piece as well as Novotest toothed driving-gear for smooth running. The weight of pressure piece is balanced out and the machine may be driven by means of a belt by fast and loose pulley from the transmission or direct by motor with belt upon fly-wheel.

Measurements.

Surface of table ...	... 40×50 inches.
Area of pressure of press beam	... 40×50 inches.
Adjustability of press beam	... $5^1/_2$ inches.
Stroke of pressure piece	... $2^3/_4$ inches.
Power required about	... 1 HP.
Number of strokes per minute	... 26.
Approximate nett weight	... ca 1840 kg.
Price	... £ 320.

Manufacture of Fountain Pens.

Fountain pen as an article of stationery is now in increasing demand, and there is accordingly a great scope

for the manufacture of such pens. In the construction of such pens many devices have been tried to regulate the flow of ink to feed the nib. In the modern penholder a feed bar conveys by cappillary action a free supply of ink to replace that which has been left on the paper in the act of writing, means being also provided by which air can pass into the reservoir and fill the space left empty by the outflowing ink. In the making of a fountain pen we have to manufacture four different parts :

(1) The hollow body which is usually made up of composition materials such as galalith, bakelite etc.

(2) Metallic parts such as ink flow-levers, clips etc.

(3) Rubber tube containers for ink, and

(4) Gold nibs with iridium tips.

At the present stage of our industrial development, it may not be possible for us to manufacture the gold nib and rubber ink containers, or the materiaI of composition for the hollow body. They shall accordingly have to be imported. But the composition material for the body could be worked into shape here. Metallic parts could be made from Indian materials. All these parts could easily be gathered here into pens.

Process of Manufacture.

The process of manufacture is simple. An automatic plant has been introduced into the market to turn out the parts which go to make the body of the pen from composition materials. The manufacture of the metallic portions is easy since it consists of simply cutting the sheet and pressing it into necessary shape with dies in an eccentric press. An ordinary mechanic can carry out every operation.

Machinery required.

Specifications of the plant capable of turning out 250 fountain pens a day are given below :—

1.	One Extrusion machine for air pressure of 30 atmospheres (with heater, heat resistance, electric lead material box, air-in-fet pipe, table etc.)	Rs. 3,360/-
	(*i*) Stop valve, reducing valve, back pressure valve, safety valve, 3 distribution leads air pipe line etc.	.. 234/-
	(*ii*) 3 air bottles	.. 140/-
2.	One eccentric press (with automatically operating feeding device) for metal parts	... 1850/-
	(*i*) One cutting and stamping die for making the small spring filling rod.	.. 173/-
	(*ii*) One combination tool for making clip fasteners	.. 345/-
	(*iii*) One tool for filling livers	.. 280/-
	(*iv*) One combination tool for making the pocket clips	.. 775/-
3.	One tin coating and polishing machine	... 2000/-
4	One foot press	.. 420/-
	Total	... 9577/-
	Duties, Insurance and Freights @ 50% on the above machines	... 4789/-
	One electric motor of 4 H.P. for the above machines	300/-
	Total	.. 14666/-

Building.

The dimensions of the fountain pens factory will be :

Length .. 35′ and
Breadth ... 25′

and it will cost about Rs. 4500/-

Economics of the Industry (per month).

	Debit		*Credit.*
1. Cost of raw material (for 6,500 pens):			
	Rs.		
(*a*) Vulcanite rod.	966/-		Production per month after allowing breakage @ 5°/₀=6275 fountain pens.
(*b*) Metallic parts (complete)	40/-		
(*c*) Rubber tubes	350/-		
(*d*) Gold nibs	11375/-		
	12731/-		Selling price of pens after deducting charges due to commissions on sales etc.= Rs. 36/- per dozen.
2. Cost of labour wages	303/-		
3. Cost of motive power	120/-		
4. Rent, Rates and Taxes @ 2°/₀ on the cost of production	301/-		
5. Repairs to plant	80/-		
6. Repairs to plant @ 10 0/0 per annum	122/-		
7. Depreciation to building @2% P.A.	8/-		Income per per month= Rs. 18825/-.
8. Packing expenses	200/-		
9. Other charges	1500/-		
Total	15365/-		18825/-
Net profit per month	... Rs. 3460		
Total out-turn per year		..	Rs. 225900/-
Totalexpenditure per year		...	Rs. 184155/-
Total profit per year		..	Rs. 41745/-

This means there will be a profit of 22.5% on the total investment.

APPENDIX.

Raw Materials.

(*a*) Vulcanite rods :—(per month of 26 days)

Weight of vulcanite rod for one complete fountain pen after allowing wastage due to boring @ 100%=30 grams.

Weight of vulcanite rod for 250 pens per day=

$$\frac{250 \times 30}{453.6} \text{ lbs.} = 16.5 \text{ lbs.}$$

Weight of vulcanite rods required for per month of 26 days. $= 16.5 \times 26$ lbs.

$= 429$ lbs.

Cost of one lb of vulcanite rod=Rs. 2/4/- per lb.

Total cost of vulcanite rod per month

$$= \frac{429 \times 9}{4} \text{ rupees.}$$

$$= \frac{3861}{4} = 965.25 = \text{say Rs. } 966.$$

(*b*) Metal parts (complete) for fountain pens. (per month of 26 days).

Weight of one complete set of metallic parts.

=4.72 grams. (where one set consists of 1 pocket clip, 1 bar and 1 lever).

Wastage of metal sheet due to cutting allowed @ 200%

Net weight of metal sheet required for one set= 14 grams.

Weight of brass sheet for 6500 pens

$$= \frac{6500 \times 14}{453.6} \text{ lbs.}$$

$= 206.0$, say 201 lbs.

Cost of brass sheet=-/3/- annas per lb,

Total cost per month of 26 days $\frac{201\times3}{16}=\frac{603}{16}$

=Rs. 37/11/-, say Rs. 40.

(*c*) Rubber tubes (per month of 26 days)=250×26

tubes = $\frac{250\times26}{144}$ gross of tubes.

Cost of one gross of rubber tubes=Rs. 7/12/-.

Total cost per month= $\frac{250\times26}{144}\times\frac{31}{4}$ =Rs. 350.

(*d*) Gold nibs (per month of 56 days)=250×26=

6500 nibs.

Cost of nibs=Rs. 21/- per dozen.

Cost of nibs for 26 days

$=\frac{6\times500\times21}{12}$ rupees= $\frac{45550}{4}$=Rs. 11375/-

Labour wages per month of 26 days.

	Rs.
1 Expert	150/-
2 Workmen @ Re. 1/- each per day.	52/-
2 Coolies @ -/8/- „ „	26/-
1 Clerk @ Rs. 30/- per month	30/-
1 Storekeeper @ Rs. 30 per month.	30/-
1 Chowkidar @ Rs. 15 „ „	15/-
Total	303/-

Cost of motive power (per month of 26 days).

H. P. of the motor=4 H. P.=4×746 watts=

$\frac{4\times746}{1000}$K. Watts.

B. O. T. units for 26 days (one day of 8 hours)

$$=\frac{4\times746}{1000}\times8\times26$$

Cost of one B. O. T. unit -/3/- per unit.

Total cost per month

$$=\frac{4\times746}{1000}\times\frac{8\times26\times3}{16}\text{ rupees}=\text{Rs. 120.}$$

Manufacture of Metallic Parts for Fountain Pens (except nibs).

Machinery required.

Specifications of a plant for the manufacture of metallic parts with a daily output of about 28800 parts are given below :—

1. One eccentric press (with automatically operating feeding device) for metallic parts.	1852/-
Dies for the press.	
(*a*) One cutting and stamping die for making the small spring filling rods.	173/-
(*b*) One combination tool for making clip fasteners.	345/-
(*c*) One tool for the filling levers.	280/-
(*d*) One combination tool for making the pocket clips	775/-
2. One foot power press for the upwards bending of the spring filling rods.	420/-
3. Polishing and tin coating machines	2000/-
	5845/-
Duties, Insurance and Freights @ 50% on above.	2923/-

One electric motor of ½ H. P. for the above machines.	150/-
Cost of erection	150/-
	9068/-

Building.

The dimensions of the building for the manufacture of metallic parts of fountain pens will be :

Length	25′
Breadth	20′

and it will cost about Rs. 2500/-

Economics of the Industry.

To discuss the economics of this industry we will take up only one part, say "Pocket clips".

Debit (per month of 26 days).	Rs.	*Credit.*	
1. Cost of raw material per month for 748800 packet clips = 16509 lbs of brass sheet @ -/3/- annas per lb.	3096/-	Net production of clips per month after allowing wastage @ 5% = 711360 clips = 59280 dozens of clips.	
2. Labour charges.	152/-		
3. Cost of motive power.	15/-		
4. Rent, Rates and Taxes @ 2% on the cost of production	258/-	Selling price of clips after all deductions such as commissions etc. = -/6/- annas per dozen.	4/-
5. Repairs to plant.	50/-		
6. Depreciation on plant @ 10% per annum.	76/-		
7. Depreciation on building @ 2% per annum.	4/-		

8. Packing expenses.	1000/-	Income per month
9. Charges for printed matter, i.e. monthly calendars to be fixed in the packet clips.	5000/-	=Rs. 22230/-.
10. Tin coating and polishing expenses.	1500/-	
11. Other expenses.	2000/-	
Total	13151/-	22230/-
Net profit per month		9079/-
Total out-turn per year.		266760/-
Total expenditure per year.		157812/-
Net profit per year.		108948/-

This means there will be a profit of 69% on the total investment.

APPENDIX.

Raw Material (per month of 26 days).

Production of clips per stroke=2.

Number of strokes per minute=60.

Number of clips per minute =60×2=120 clips.

Efficiency of the machine, say 50%, *i.e.* 60 clips per minute.

Production of clips per month=60×60×8×26= 748800 gms.

Weight of one clip=2.52 grams. Allowing wastage

@ 200% = $\frac{5.04}{7.56}$ grams, say 10 grams.

Total weight of raw material per month = 7488000 grams.

$= \frac{7488000}{453.6}$ lbs. = 16509 lbs. Cost of raw material = -/3/- annas per lb. Totol cost per month

$= \frac{16500 \times 3}{16}$ = Rs. 3096.

Labour wages (per month of 26 days).

One expert @ Rs. 60/- per month.	60/-
One workman @ Re. 1/- per day.	26/-
Two coolies @ Re. -/8/- each per day.	26/-
One clerk who will also serve as Storekeeper @ Rs. 40 per month.	40/-
Total	152/-

Cost of motive power (per month of 26 days).

H. P. of the motor = ½ H. P. = ½ × $\frac{746}{1000}$ killowatts.

B. O. T. units for 26 days (one day of 8 hours).

$= \frac{746}{2 \times 1000} \times 8 \times 26$ units.

Cost of one B.O.T. unit = Re. -/3/-.

Total cost per month

$= \frac{746 \times 26 \times 8 \times 3}{2000 \times 16} = \frac{373 \times 39}{1000}$ = Rs. 14.5, say Rs. 15

Office Tags and Shoe Laces.

The process of manufacturing these articles of every day use is very simple and one machine can produce them both in any shape required, such as flat ; round and tabular. A plant capable of producing 200 laces of 24" length in a

working day of 8 honrs will cost about Rs. 1,000, and can be expected to give a return of about 20 per cent. The raw material for the industry is available in the country and the machinery can be worked by an ordinary trained mistri.

Office tags and shoe laces can be manufactured on the same machinery. Both these articles are in daily common use. The figures are not available to show their consumption, but it can be estimated that it must be on the whole worth a few thousand rupees. Specifications for a plant of moderate sixe are given below :—

One Double machine to double till to 6 threads fitted with braider bobbins, and One set of steel spindles, with one set of swifts for cotton yarns.	£. 30/15/-
Reeling machine type BH to reel the finished boot laces or tags in lengths, the arms of the reels with scale, also the reeler with counting apparatus to count the revolutions and fitted with knife to cut the tags and boot laces.	£. 12/-/-
Lapping apparatus for lapping the finished pieces of boot laces in selling pieces, without counting apparatus.	£ 1/8/-
Total Cost	£ 44/7/-

These prices are F. O. B. German port of embarkation and were current in August 1931. The total equipment complete with driving power and fittings will cost Rs. 1,000/-,

The laces and tags may be made in different forms say, flat, round or tabular. The output of the braiding

machine varies with the density of the braid and the kind of the article to be made.

Yarn for the manufacture of these can be purchased from Amritsar or Calcutta. One lb of yarn would give:

(a) 112 pairs of shoe laces 24″ long of round cord.

(b) 200 „ „ „ „ „ „ of flat cord.

(c) 200 „ „ „ lags „ „ of round cord.

The price of yarn required for shoe laces is Rs. 1/4/- and for tags 8 annas per lb.

Adding to this 50 p.c. on account of manufacturing and other charges, the prices would work out as below :—

Price of 100 pairs of round cord shoe laces. Rs. 1/11/-

Price of 100 pairs of flat cord shoe laces. -/15/-

Price of 100 pairs of round cord tags. -/6/-

The whole sale price of these as current in the local market are as follows :—

Shoe laces (round)	Rs. 2/4/-	per hundred.
Shoe laces (broad)	Rs. 1/11/-	„ „
Tags	Rs. 1/-/-	„ „

This gives a profit of annas 9, annas 12 and annas 10 respectively per 100 pairs produced.

Pencils and Pen-holders.

There is not a single factory in the Punjab manufacturing these goods. In Calcutta and Madras these factories are now known to work profitably. It is true that the principal raw material required for this industry, i. e. graphite, is not found in the province and that probably wood shall have also to be imported, but factories in other provinces are also importing these raw materials from outside the country, though in our case a good wood has been reported by the Forest authorities to exist in near proximity, *viz.* in the

dry hills of Baluchistan. Specifications of a plant for the manufacture of lead pencils of capacity approximately 50 to 70 gross in one day are given below :—

Lead Machines

1 Drum mill for wet-grinding for 100 Kg mixture with electric drive	R.M. 1170/-
1 Crushing roller for graphite and clay (roller sizes : 450×245 m/m) with transmission drive	1240/-
1 vertical screw press for leads with transmission drive	2050/-
1 Burning-stove, resp. the iron parts about	660/-
10 Graphite burning-boxes a Mk : 12.	120/-

Wood working Machines.

1 Circular saw with motor complete with starr connection and safety catches	1320/-
1 Slit saw with slide and tranmission drive	660/-
1 Grooving and shaping machine with hand insertion and transmission on drive	1225/-
1 Tools-grinding machine or grinding the rounders and groovers with sand paper	310/-
10 Single glue-clamps. a Mk : 31	310/-
1 Slats grinding drum with transmission drive	635/-
1 automatic crosswise sandpapering machine for round pencils with transmission drive	1115/-

1 automatic crosswise sandpapering machine for hexagon pencils, for transmission drive		2310/-
1 automatic polishing machine for shellac or Cellesta varnishes, with transmission drive		1500/-
1 end trimming drum with transmission drive		580/-
1 handstamping press for foils with electric heating, resistence, cable and plug	R.M.	390/-
1 dipping apparatus		165/-
Total		30,305/-

The prices above are in German Reichmark, which at the present rate of exchange are 15 to a £. The prices were current on June 1931. This roughly means that the plant would cost about £2,020 -, and with driving power, fittings and buildings about Rs. 50,000 - in all.

For the manufacture of pen holders the following additional machines would be required :—

1 Machine for grinding the pens to shape (conical or convex)	R.M.	690/-
1 Drilling Machine for making hole at one end for inserting tips.		610/-

NOTE.—If it is desired to make iron tips as well, one share, one punch and one press would be required.

The economics of the industry is discussed below :—

Cost of manufacture 100 gross of lead pencils.

1. Cost of 55 lbs of graphite @ Rs. 1/8/- per lb.	77/8/-

2.	Cost of 55 lbs. of clay @ -/3/- per lb	10/4/-
3.	Cost of 35 cubic feet of wood @ 2/8/-	87/8/-
4.	Price of other raw materials, e.g. glue, foil colour etc.	5/-/-
5.	Cost of manufacture	18/8/-
6.	Other expenses including overhead charges, depreciation, interest etc.	36/-/-
	Total	234/12/-

Income.

Price of 100 gross of pencils @ Rs. 3/- per gross. 300/-

Net profit per 100 gross of pencils produced. 65/4/-

(The above estimates have been submitted by Director of Industries, Lahore).

The Director of Industries, Travancore writes :—

The question of pencil manufacture has been before the people of India for a long time, but no steps were taken for starting this industry. The main reason for this discussion is the success of the industry in Madras. This Industry like others, is one which had to stand great competition after war and unless it is started on a thorough business scale, it will not succeed at all. The Austrain, German, and American pencils are of exellent quality and have attained a great reputation. They are cheap also and is over competition keep to scure the market. In India there seems great scope for this industry and it is certain it will meet with succcss, if worked by a specialist.

The important raw products for the manufacture of pencils are (1) soft wood, (2) pure graphite. In India these two articles are obtained without difficulty and the

manufacture of pencils may be started with advantage. From the report of the Forest Department it is seen that suitable soft wood is obtained in large quantities.

The qualities of wood used for pencil manufacture may be noted.

1. The wood must be of uniform colour.
2. It must be of quick growth.
3. The veins should run lengthwise and should be straight.
4. The absence of knots is extremely important.
5. The softer the wood the more useful it is for pencils.
6. It must be capable of taking a good polish.

Graphite is found in large quantities and the mineral is sufficiently pure for the purpose. Travancore graphite is in demand for pencil making in Mysore and other parts of India. This mineral can thus be had in large quantity for pencil manufacture. A sample of Travancore graphite has heen analysed in the Institute of Science, Bangalore, and was found to have the following composition.

Carbon 94.4 per cent.
Mineral ash 2.1 per cent.
Volatile impurities 2·1 per cent.

This is tolerably pure for our purpose.

Preparation of Graphite.

Graphite is powdered in a mill and is freed from sand and other impurities by mechanical processes. The chemical process of purification has been tried but was found to be very costly. Mechanical methods are therefore adopted in all cases. The pure graphite is mixed with clay and the

mixture ground as finely as possible. The greater the fineness of the mixture the better will be the quality of the pencil. The proportions of clay and graphite vary according to the nature of the pencils to be made. The greater the proportion of clay, the harder is the pencil. For ordinary pencils, 5 parts of graphite are mixed with four of the clay. For hard pencils, equal quantities of clay and graphite are mixed together.

The finely divided mixture is put into a filter press and the water expressed. The gritty mass is then transferred to a roller mill where it is mixed with fine borax powder. The product of this treatment must have a certain consistency so that it can be made into balls of uniform shape and size.

The graphite balls are then put into a press, from which they emerge as threads of the desired shape and thickness and diameter. They are cut into convenient lengths, smeared over with French Chalk, kept on boards made for the purpose, and tried. These are cut to the required lengths by means of a saw.

The "Lead" of the pencil has to undergo another operation before being ready for use. The dry "lead" is arranged in a box and the interspaces are filled with graphite powder. Some alcohol is poured into the box so that the contents are thoroughly wet. The lid is fitted, the box covered with clay, and baked in a specially constructed oven.

The baked lead is dipped in molten wax and allowed to cool. The wax is afterwards scraped off from it and the lead is ready for use.

The machines required for the wood work are a grooving machine and a rounding machine. Slabs of wood $7'' \times 4'' \times 3/8''$ are taken and carefully marked with a centre

line down the back. It is on accurate centring that the success of the pencil finally depends. The grooving and rounding machines are similar to ordinary planing machines with special cutting edges. The final rounding is done in two processes, each opposite side is rounded separately. These are placed in the grooving machine where they are grooved. Generally each slab will have six grooves. The prepared lead is kept in the grooves and two slabs are glued together with the leads inside. The slabs are kept in a press for a couple of days. The so prepared slab is then put in a rounding machine where it is rounded and polished. A coat of varnish or polish is given to pencils of superior quality.

Expert care and advice as to the preparation of graphite and clay as well as upon the choice of wood to be used in the manufacture in essential. Much research work in this direction could be done in Travancore. Expert advice is available.

The existence of China clay in India opens up another opportunity for the pencil manufacturer in this country. The value of this material in making coloured chalk pencils cannot be over-estimated. Red and blue chalks can be made with ease from it.

Manufacture of Penholders.

The Director of Industries, Punjab writes:—

Penholder is an important article of office stationery. Statistics are not available to show the value of this article consumed in the province. It can, however, be stated that the consumption is considerable. Most of the penholders used are imported from foreign countries. A very small proportion of Indian make is used. Recently a factory has been started for the manufacture of penholders in Amritsar and another factory is under erection in Lahore. There is, however, room for a few more such factories. The raw

material for the manufacture of penholders is abundantly available in the country. Wood of good quality can be had from the Punjab forests. Samples of Punjab deodar, kail, shisham, jund, mulberry and bamboo were sent to Germany to find out by experiments whether they were suitable for penholders. With the exception of bamboo, these have been reported to be quite suitable for the manufacture of penholders. For the manufacture of metallic parts, iron and tin sheets are obtainable from Tata's Tin and Steel Sheet Works.

Process of Manufacture.

For the manufacture of penholders two separate operations are required. Firstly the making of the wood handles, and secondly the making of the metallic parts. The handles are made from the rods prepared from wooden planks by turning them into required shape and size on the machines. Holes are then bored into flat end of the shaped rod for fixing the metallic part. The metallic parts are made by punching metal blanks in cutting press and rounding into the required shape in a rounding machine. The fixing of metallic part into the handles is done by hand. The handles when made from wood are varnished and polished.

Machinery required.

Specifications of the plant for producing 50 gross of penholders per day are given below :—

1. One slat saw with slides for cutting the planks to slats 490/-/-
2. One grooving and shaping machine with band feed 1,026/10/8
3. One tools grinding machine with sand paper drum 261/5/4

	Brought Forward	1,778/-/-
4.	One conical forming machine with grinding disc	700/-/-
5.	One penholder boring machine complete with automatic centering.	490/-/-
6.	One Tanon cutter. (This machine is usuable on the boring machine).	48/11/6
7.	One rounding head for operating the pen-holders.	42/-/-
8.	One polishing and finishing stand	242/10/8
9.	One dipping apparatus complete.	140/-/-
10.	One dipping board.	11/3/3
11.	One hand stamping machine with foils etc. complete.	303/5/4
12.	One cutting press for the metal tips with one tool.	555/5/4
13.	One rounding machine driven by hand for rounding and punching the tips including one tool.	1152/8/10
14.	Accessories.	335/7/4
	Total	5799/4/3
	One electric motor of 6 H. P. for the above machines.	600/-/-
	Duties, insurance @50%	2899/10/0
	Total	9298/14/3

Building.

The dimensions of the building for the penholders industry will be :

Length	40'
Breadth	25'

and it will cost about. 4500/-

Economic of the Industry.

Debit. (per month of 26 days).	Rs.	*Credit.*
1. Cost of raw material for 178200 penholders :		Net production of penholders per month after allowing breakage @ 5%=177840 penholders. = 1235 gross of holders.
(*a*) Deodar wood.	182	
(*b*) Varnishes and colours.	407	
(*c*) Metallic parts.	156	
	745	
2. Cost of labour.	619	Selling price of one gross of holders after all deductions such as commission, brokerage etc. = Rs. 2/4/- per gross. Therefore income per month = Rs. 2778/-.
3. Cost of motive power	175	
4. Rent, Rates and Taxes @ 2% on cost of production.	44	
5. Repairs to plant.	50	
6. Depreciation to plant @ 10% per annum.	78	
7. Depreciation to building @ 2% per annum.	8	
8. Packing expenses.	250	
9. Other charges.	250	
Total	2219	Total 2778/-
Profit per month		Rs. 559/-

This means there will be a profit of 25.1% on the total investment.

Total out-turn per year.	33336/-
Total expenditure per year.	26668/-
Net profit per year.	6708/-

APPENDIX.

(a) *Raw material.* (per month of 26 days).

Wood. One log of deodar wood of dimensions $5'' \times 10'' \times 9'$ will produce 50 gross of penholders and will cost Rs. 7/- (after allowing wastage due to sawing and rounding). Number of penholders to be produced per day = 50 gross. Cost of wood per day = Rs. 7/-.

Cost of wood for 26 days = Rs. 182/-.

Varnishe and colours.

Cost of varnish and colours per gross penholders = Re. -/5/- approximately. Cost of colours and varnish per

$$\text{day} = \frac{5 \times 50}{16} \text{ rupees.}$$

∴ Cost of colours and varnish for 26 days

$$= \frac{5 \times 50 \times 26}{16}$$

= Rs. 406/4/-, say Rs. 407/-.

Metallic parts.

Weight of metal parts for one holder = 1.7 grs.

say = 2 grs.

Weight for 50 gross of holders per day = $\frac{2 \times 50 \times 144}{453.6}$ lbs.

= 31.7 lbs.

Say 32 lbs of metallic sheets.

Cost of metal sheet = Re. -/3/- per lb.

Cost per day for metallic parts = $\frac{32 \times 3}{16}$ rupees.

= Rs. 6/-.

Cost of metallic parts for penholders for 26 days = $6 \times 26 = 156$ rupees.

(*b*) *Labour wages.* (per month of 26 days).

One Expert @ Rs. 150 per month.	Rs.	150/-
1 Mistri @ Rs. 30 " "	"	30/-
12 workmen @ Re. 1/- each per day.	"	312/-
4 coolies @ Re. -/8/- " " "	"	52/-
1 clerk @ Rs. 30 per month.	"	30/-
1 storekeeper @ Rs. 30 per month.	"	30/-
1 chowkidar @ Rs. 15 " "	"	15/
	Total Rs.	619

(*c*) *Cost of motive power.* (per month of 26 days).

H. P. of the motor = 6 H. P. $= \frac{6 \times 746}{1000}$ K. Watts.

B. O. T. units per month of 26 days $= \frac{6 \times 746 \times 8 \times 26}{1000}$

Cost of one B. O. T. Unit = Re. -/3/-.

Cost per month of 26 days $= \frac{6 \times 746 \times 3 \times 8}{1000 \times 16}$

= Rs. 175/-.

Manufacture of Pins.

Pins are used in fastening paper or fabrics and are a very important article of office stationery. The Government of India Stationery Office alone buys pins to the extent of Rs. 2,000 a month. There is only one factory in the whole of India at present which is producing pins on a modest scale. The manufacture of pins is not very difficult and only two principal machines are required for this purpose.

Process of Manufacture.

"In a modern pin-making machine, wire of suitable gauge running off a reel is drawn in and straightened by

passing between strightening pins or studs set in a table. When a pin length has entered it is caught by laternal jaws, beyond which enough of the end projects to form a pin head. Against this end a steel punch advances and compresses the metal by die arrangement into the form of a head. The pin length is immediately cut off and the headed piece drops into a slit sufficiently wide to pass the wire throughout but retains the head. The pins are consequently suspended by the head while their projecting extremities are held against a revolving cutter, by which they are pointed. They are next cleaned by being boiled in weak beer, and then arranged in a copper pan in layers alternating with layers of grained tin. The contents of the pan are covered with water over which a quantity of argol (bitartrate of potash) is sprinkled, and after boiling for several hours the brass pins are coated with a thin deposit of tin, which gives them their silvery appearance. They are then washed in clean water, and dried and polished by being revolved in a barrel mixed with dry bran or fine sawdust, from which they are winnowed finished pins. A large proportion of the pins sold are struck into paper by an automatic machine not less ingenious than the pin-making machine itself."

Machinery used.

Specifications of the plant capable of producing 1200 pins per minute of sizes varying from $^{3}/_{4}$" to $1^{1}/_{4}$" are given below :—

*6 automatic pin head and point making machines	55200/-
1 tin quoting equipment.	1000/-
1 drawing and polishing equipment.	1000/-
1 automatic machine for sticking the pins into the paper.	4500/-

1 electric motor of 8 H. P. to run the machines	800/-
Total	62500/-
Duties, Insurance and Freight @ 50%	31250/-
Total	93750/-

The above machines are American and the price of the dollar has been taken as Rs. 4.

* It is not necessary to instal in the beginning all the six machines. To start with pins of only one size may be produced.

Building.

The building shall be about 20′×35′ and will cost about Rs. 4000.

Labour wages.

1 Expert @ Rs. 150	Per month.			150/-
9 workmen @ Rs. 20	„	„	each	180/-
4 coolies @ Rs. 15	„	„	„	60/-
1 clerk @ Rs. 30	„	„	„	30/-
1 storekeeper @ Rs. 45	„	„	„	45/-
1 chowkidar @ Rs. 15	„	„	„	15/-
Total				480/- per month.

Economics of the Industry.

Debit.		*Credit.*
Cost of 3456 lbs. of iron wire @ -/4/- per lb. for 17280000 pins per month =Rs. 864.		Sale price of pins -/3/6 per 1000. Income per month.
To allow wastage. Say.	870/-	=Rs. 3780.

Labour wages @ a month	480/-	
Cost of motive power @ a month.	270/-	
Rent, Rates and taxes @ 2% on the cost of production.	60/-	
Repairs to plant @ a month	150/-	
Depreciation to plant @ 10%	781/-	
Depreciation to building @ 2%	7/-	
Other charges	500/-	
Total	3118/-	3780/-

Net profit per month. Rs. 662.

This means there shall be a return of 21% in the first year on the total investment.

The raw materials for the manufacture of pins will have to be imported from outside.

(The pins are made of brass wire and not of iron wire, as calculated by the Industrial Surveyor. The estimate may be corrected accordingly Author).

Mauufacture of Slates.

The Director of Industries of Bombay writes:—

School-boy slates are mostly imported from the Continent into India. There are few slate manufacturing factories worked by hand whose production is negligible. Germany is the largest exporter of school-boy slates. There are no statistics of the quantity of slates imported into Bombay Port as this is not taken separately but included into the imports of stationery. We may place Bombay's consumption on an intelligent analysis at about 25000/30000 cases of school-boy slates annually. There is also the promise in the near future that primary education would

increase thereby increasing the annual consumption and this would probably always hold. In order that the new industry could complete successfully with an established market backed up by organisation of sales with the technical skill aquired over the period of half a century. It should possess natural advantages such as :—

(a) Abundant supply of raw materials.

(b) Sufficient supply of labour.

(c) Cheap power.

(d) Local market.

On the basis of the above requirements different authorities were referred to and local inquiries made which are given as under :—

(a) *Raw Materials.*

There appears to be good supply of raw materials for manufacturing slates. Wood for slate frames is available in this Presidency. The Forest Economist who was referred to recommended the following classes of timber for manufacturing frames for the slates.

Adina Cordifolia (*Haldu*) available anywhere in India.

Terminalia Bialata (*Chuglam*) Calcutta.

Gmelina Arboria (*Gamhar*) anywhere in India.

Vateria Indica (*Balliviny*) Bombay and Madras.

Mechalia Species, Assam and Bengal.

For the Bombay Presidency he specially recommended the following species of the forest wood which I detail below, each quality separately :—

Adina Crodifolia.

Trade name *Haldu* is the timber which may be described as similar to lustreless satin wood and is of light yellow or

straw colour, excellent as turning and carving wood and for purposes of fittings to toys etc.

Weight per cubic ft. is - 40 lbs.

Prices approximately f. o. r. Bombay Rs. 60 to Rs. 100 per ton.

Gmelina Arboria.

Trade name *Gumhar*, usually pale, yellowish, reddish brown in colour, closed grained and working easily to a fine finish, it is excellent wood for making furniture, boxes and general utility work being durable and specially so under water.

This department had sent a sample of wood used for making slate frames to the Forest Economist who reports that this wood is called Adin Cordifolia and is available in this Presidency.

Slate Slabs.

The Director of Geological Survey of India who was referred to on the question of slate quarries for the supply of slate slabs to manufacture slates informs us that there are no slate quarries in this Presidency. Slate will, therefore, have to be railed either from Bihar and Orissa or the Punjab and he gave us the names of the following firms who quarry slates for export :—

Ambler Slate and Stone Co. Ltd., Bihar and Orissa.

Kangra Valley Slate Co. Ltd., Lahore.

This department made enquiries from the firms for the supply of slates similar in sizes to those imported localiy. The firms have sent us the following particulars.

Ambler Slate and Stone Co. Ltd.

Special dressed quarry slates of the approximate thickness 3/16" thickness.

Sizes of slates.	Prices f. o. r. Station near quarry.	Prices f. o. r. Bombay, including delivery to factory.
12" × 8"	Rs. 6/8/-	Rs. 8/5/-
10" × 8"	„ 5/8/-	„ 7/3/-
8" × 6"	„ 3/-/-	„ 4/11/-

Railway freight is based on a wagon load of slates. The minimum number of wagons necessary for obtaining low freights would be 2 or in other words 40,000 slates would have to be indented for at one time which would be equal to one month's output of this factory for a total number of 260 working hours. The cost per mound of slates f. o. r. Bombay from Dharahara, a distance of 1008 miles approximately from Bombay, would be Rs. 1/1/- per maund. Allowing 5% for breakage in transport and handling, the average price of slates per box of 100 would be Rs. 7/4/- factory delivery.

Kangra Valley Slate Co. Ltd., Kund via Rewari.

Approximate distance from Bombay is 784 miles.

Prices for specially quarried school slates approximately 1/8" thickness in :—

Sizes	f. o. r. Kund.	f. o. r. Bombay factory
$12\frac{1}{2}'' \times 8\frac{1}{2}''$ $11\frac{3}{4}'' \times 7\frac{3}{4}''$ $10\frac{1}{2}'' \times 7\frac{1}{2}''$ $8\frac{1}{2}'' \times 6\frac{1}{2}''$	Rs. 40 per 1000	Rs. 52/8 per 1000

Railway freight is based per wagon load and averages Rs. -/13/- per maund, between Kund and Bombay for a distance of 784 miles. Allowing 5% for breakage, we get the price of average size of slates for a box of 100 as Rs. 5/4/- factory delivery.

It will be observed from the above details of the raw materials available that the question of abundant supply of raw materials is more than fulfilled.

(*b*) *Sufficient supply of labour.*

There is plenty of labour in the local market both skilled who could be easily trained for manufacturing slates.

(*c*) *Cheap Power.*

There is plenty of cheap electric power available locally.

(*d*) *Local market.*

There are no statistics available for total imports into Bombay of school-boy slates, but it can safely be placed at from 25000 to 35000 cases per annum as Bomhay share. This quantity is large enough for 3 to 4 factories similar to the one in this estimate. The question of a market is thus amply fulfilled:

In the estimate for a factory to manufacture school-boy slates, I have taken the output for this factory as 80% of the probable imports of school-boy slates into Bombay Port. The output of this factory is sufficient for an initial start and a factory organised for this output is likely to be a commercial success. The machinery output is for a working day of 8 to 10 hours. I have taken it as 10 hours in order to err on the safe side. It is proposed to manufacture school-boy slates and slate pencils in assortment of 60 and 70 slates per case and 25000 slate pencils per case, as follows :—

Imported Sizes of school-boy slates	Case of 60 slates.		Case of 72 slates.
7" × 5"	12	or	24
8" × 6"	"	or	24
9" × 7"	"	or	24
10" × 7"	"		
11" × 7"	"		

School-boy slate-pencils one case contains: 5000 pencils or 100 boxes of 50 pencils in each box.

The slates will be manufacutured on automatic machinery which would require attendants of average intelligence. Raw materials will be imported from the slate quarries of the Punjab and the forests of this Presidency. Packing boxes for both slates and pencils will either be made on the premises from wooden planks or bought ready made from dealers in the local market. The transport of

the raw materials to factory and the finished products to the market will be carried out on their own motor lorry provided for in the estimates. Details of machinery, raw materials, expenditure etc. is given below, all items which would be necessary in such a factory have been shown separately. There are other side lines of manufacture which could be carried on the same machinery, such as, photo frames, wooden frames, window glass frames, fittings, foot rules, polishing of other kinds of marble slates etc. which may be required by the local dealers. This is not considered in the estimate, but mentioned for future reference.

Machinery Investment.

This plant is capable of manufacturing a maximum of 40 cases of slates with European labour in 8 to 10 hours. We have assumed 30 cases of slates as present maximum for Indian conditions and a 10 hours' working day.

The Frame Making Machinery.

	Rs.
(*a*) D. L. K. Circular Saw for lathes, H.P. 10-15	1416
(*b*) H.H. A. 15. Four cutter planning and moulding machine, with four cutter blocks H. P. 6.	2578
Price of 2 Milling Cutters for above.	40
(*c*) P. S. J. Parallel Pendulam Saw, without belt, with Motor of 2 H.P. with command box.	405
(*d*) C. D. F. Tenoning Machine, with 6 shafts, 2 special Milling Cutters, coupled with Motor 3 H. P. and a vertical motor 2 H.P. (Altogether H. P. requir e 5).	3294

(*e*) C. F. D. Stitching Machine with 2 Cutter heads one horizontal, the other vertical with 2 Motors of 1 1/2 H. P. each. (3 H. P. total). 1650

(*f*) C. C. M. Moulding Machine of 2 spindles, for rounding the corners of the slate frames, with 5 backed off milling cutters, and 2 apparatus capable of to and for sliding in certain fixed angle for rounding corners of 2 slate frames at one time H. P. 4. 2092

(*g*) "Germania'; 2 Cylinder Grinding Machine for driving through Motors H. P. 10 ; complete with cost of Motors. 4860

(*h*) Machine to print Trade-Mark as per prosp. "La Petite Sans Rivale" including cost of Sterio H. P. 1/2. 350

Machinery for working stone-slabs obtained from the quarries in required measurements in natural unpolished condition.

Rs.

(*a*) " Meko " Machine to grind and polish surface of stone slabs, H.P. 7 cost including motor. 2720

(*b*) S. 400 Fickert Machine to cut edges of slabs to make them perfectly clean to admit the frames on, H. P. 6. Cost including the price of motor. 1885

Machinery for manufacturing slate pencils from waste of slabs and from small blocks of stones.

Rs.

(*a*) Machine to cut Stone-Blocks into slabs. 575

	Rs.
(*b*) Machines to cut slabs into a square strips.	500
(*c*) „ „ „ strips into required lengths.	170
(*d*) „ „ grind strips into round polished pencils.	750
(*e*) „ „ make ends of pencils pointed.	600

Mechanic Shop Machinery.

(*a*) One self-acting, screw-cutting Lathe or medium length.	700
(*b*) One shaping machine medium.	600
(*c*) One small drilling machine.	200
(*d*) One set of black-smith's tools.	200
(*e*) One set of carpenter's tools.	100
(*f*) One fine tool-grinding machine.	100
(*g*) One rough tool-grinding to be worked by hand.	25
To cost of electric motors not provided for in the estimates of the wood working, slate pencil manufacturing and the machine shop machinery.	1850
To cost of cables, connections, Disc. Boards. fuses etc.	1750
To cost of electric lights wiring complete.	300
To cost of shafting, gearing, belting etc for drawing machines which have no motors.	1200
To cost of furniture, charts safe, cupboard, store-roam racks, tables etc.	1500
To cost of machinery foundation erection, installation etc.	2800
To cost of ½ ton motor lorry for transport of raw materials and finished slates complete with body.	3600
Total	38810

Depreciation at 7% and interest at 6½ per annum. } Rs. 5006/-per annum. } Rs. 417/2/- per month.

Raw materials.

Wood per case of 60 slates. We shall require nett wood 873 cubic inches as follows :—

Length	Breadth	Thickness.
7" × 2"	1"	½" × 2
5" × "	"	"
" × "	"	"
6" × "	"	"
9" × "	"	"
7" × "	"	"
10" × "	"	"
7" × "	"	"
11" × "	"	"
7" × "	"	"

Allowing 30 p.c. to 40 p.c. waste in sawing and dressing, we get 1180 cubic inches.

Cost of one cubic foot of wood Rs. 80/- per ton. Rs. 1/9/6.

Cost per case of slate Rs. 1/4/-.

Cost per month for 780 cases of 60 slates each case = Rs. 975/-.

For making 780 cases of slates per month.

Slates Stones sold by the Kangra Valley Slate Co.

Cost of Rs. 40/- per 1000 slates ex-quarry,	= Rs. 40/-.
Railway freight to Bombay per 1000 slates	„ „ 12/-2.
Handling and transport cost to factory from station.	„ 0/6
Total per 100	„ 52/8/-
Cost per 100	„ 5/4/-
Cost for 60 slates	„ 3/4/-
Cost per month for 780 cases of slates each case 60 slates.	„ 2535/-/-
Plus 7 p.c. for breakage	„ 177/-/-
Total per month	„ 2712/-

Slates for making 130 cases of slate pencils:
Slabs to be used will be $10\frac{1}{2}'' \times 7\frac{1}{2}''$.
Pencils sizes will be $7/32''$ dia. $\times$ $6\frac{1}{2}''$ long.
One case = 5000 pencils.
One slab will give roughly 28 pencils. For 15,000 Pencils we will require in all 896 stone slabs per day.

Cost of 896 stone slabs at Rs. 5/4 per hundred	Rs. 469/
Add 10% for breakage.	46/14/-
Total	515/14/-

Total cost of raw materials per month.

For 780 cases of slates each case containing 60 slates, total amount of wood repuired.	Rs. 975/-/-
do do slates slabs.	2712/-/-
For 130 cases of pencils, each case 5000 pencils, Stone slabs required.	515/14/-
Total	4202/14/-
Per month, say	4200/-/-

Other items of expenditure per month of 260 hours.

To cost of factory rent	Rs.	150/-/-
„ „ „ electric power charges		750/-/-
„ „ „ lighting charges		12/8/-
Spare parts repairs, waste, lubricatimg oil etc.		235/-/-
Insurance on plant stock and stock in process of manufacture on Rs. 30,000 at annas six per cent		9/8/-
To cost of petrol, lubricating oil, spares, repairs etc. for motor lorry, wheel tax etc.		240/-/-
To cost of stationery, advertisement, labels, string etc., nails, iron hoofs.		70/-/-
To cost of 780 packing cases for slates.		400/-/-
To cost of 130 large and 13,000 small boxes for pencils.		289/-/-
Total		2156/-/-
Say		2200/-/-

Labour and wages per month of 260 hours.

1	Slate manufacturing specialist	Rs.	250/-
8	Operatives for the slate frames making machinery @ Rs. 1/-		240/-
2	do slate slabs polishing machinery @ Rs. 1/-		60/
3	do slate pencil making machinery @ Rs. 1/-		78/-
1	Fitter for carrying out repairs to machinery		45/-
1	Turner for working on the lathe		40/-
1	Foreman and supervisor		60/-

1	Blacksmith	Rs. 65/-
1	Hammerman	20/-
1	Oiler to look after oiling of shafting, machinery etc.	20/-
1	Electric man to look after electric lighting and motor	50/-
1	Carpenter for packing slate boxes	40/-
1	do for slate pencil boxes	46/-
6	Coolies for unloading slate slabs and loading slate boxes into lorry etc.	156/-
1	Motor lorry driver	60/-
1	Motor Lorry cleaner	26/-
1	Chowkidar	20/-
1	Cashier	60/-
1	Clerk	45/-
1	Sweeper	13/-
Total : 35 men		Total per month. Rs. 1374/-
		Say 1400/-

Working Capital required for 3 month.

To cost of 3 month's wages	4202/-
„ „ „ raw materials	12500/-
„ „ „ of other items of expenditure.	6150/-
Total	Rs. 22952/-
Say	23000/-

To cost of manufacturing 780 cases of school-boy slates and 130 cases of slate pencils per month of 20 days or 260 hours.

„ cost of slate slabs for making 780 cases of 60 slates in each case. 2712/-

To cost of wood for frames for 46800 slates.	Rs. 975/-
„ cost of slate slabs for making 130 cases of 5000 pencils in each case.	516/-
„ cost of factory rent.	150/-
„ cost of electric lighting charges etc.	12/-
„ cost of electric power charges.	750/-
„ cost of spare parts, stores, lubricating oil.	230/-
„ cost of petrol, spares, lubricating oil, water, repairs, for motor lorry.	240/-
„ Insurance on plant, stock and stock in process.	9/8/-
„ cost of stationery, labels, advertisement, paper, nails, hoofs, iron, glue, etc. etc.	80/-
„ cost of packing cases for packing 780 cases of slates.	400/-
„ cost of packing 130 cases of pencils.	289/-
„ cost of wages.	1374/-
„ cost of interest on working capital.	115/-
„ depreciation at 7 p.c. and interest at 6 p.c. on capital investment.	417/2/-
Commission 2 p.c. on sales of slates and pencils.	195/-
Total	8465/2/-

In the calculations for profit and loss I have not taken full output of machinery per year as sales; this is not commercially feasible. Annual sales and outputs depend on competition, demand, breakdown in the plant etc. I would say 80 p.c. of the above production would be an equitable bases for costs, and profit and loss. We then get the following returns :—

To return from sales based on 80°/₀ of the total output of the slate manufacturing plant *viz.* 7488 cases of slates at Rs. 10 per case and 1248 cases of slate pencils at Rs. 15 per case.	93600/-
To total expenditure.	90540/-
Net profit per year.	3060/

(It should be noted that the overhead charges detailed as above remain constant whether factory is producing 100% or 80% of its capacity. The only items of expenditure which would vary according to the output of the factory would be the raw materials).

Gross profit per year.

Nett profits per annum.	3060/-
To return of interest on working capital.	1560/-
To return of interest on capital investment.	2310/-
Total	6930/-

To total return on capital investment exclusive of taxes.

Nett Rs. 3060/- 5 p. c.
Gross „ 6930/- 11 p. c.

It is possible to increase the production of the machines as well as the sales of the manufactured slates and pencils. We would then be able to realise the following returns on the capital investment for 10 hours working day.

To returns from sales of 9360 cases of slates, 60 slates per case, and 1560 cases of slate pencils of 5000 pencils in each case.	117000/-
To total expenditure on slate manufacture.	101580/-
Nett profits.	15420/-

Gross Profits.

Net Profits per annum.	15420/-
Returns of Interest on working capital.	1560/-
„ on capital investment.	2310/-
Total	19290/-

To total returns on capital investment etc. exclusive of taxes.

Nett Rs. 15420/- 25.60 p.c.
Gross „ 19290/- 32.00 p.c.

Summarising.

Total capital investment for machinery.	38510/-
„ for 3 months' working capital.	23000/-
Total Investment	61510/-
Total annual returns 100 p.c. output.	117000/-
„ „ 90 p.c. „	105300/-
„ „ 80 p.c. „	93600/-

Estimated profits and loss.

		Rs.	per cent.
On 100 p.c. output and sales	Net profit	15420	25.60
	Gross „	19290	32.00
On 90 p.c. output and sales	Nett „	9166	15.00
	Gross „	13036	21.00
On 80 p.c. output and sales	Nett „	3060	5.00
	Gross „	6930	11.50

If the market is satisfied with the quality of slates the demand for more slates can be met by working the factory in either two or three shifts without putting any extra capital for machinery etc. On the whole the scheme has a fair chance of success and deserves serious consideration by investors in India.

NOTE.—Figures of manufacturing costs including those of machinery and raw materials are those ruling in the latter half of 1930.

APPENDIX I.

Dealers in Adina Cordifolia (Haldu) Timber.

Mr. K. R. Patil, Alnavar, Kanara Division. (M.S.M. Ry.)
„ V. R. Savnoor, Haliyal, „ (Kanara Dist.)
„ H. P. Belamkar, Hubli. (Dist. Dharwar).
„ N. V. Basti, Dhundashi, „ „
„ Manjunath Venkappa. Mundgod, (Dist. Kanara).
„ Dawood Husein Abdulla, Hangal, (Distt. Dharwar).
„ Rajesab Nannesab Shibargatti, Dist. Dharwar).
„ Hatelsab Ranusab, Hubli, (Dist. Dharwar).

APPENDIX II.

Slate Machinery Manufacturers.

Guyton & Cumfer Mfg. Co., 4451-59, Fillmore Street Chicago, Illinios, U.S.A.
Burk & Fox , Forest, Ohio, U. S. A.
S. Flory Mfg. Co., Bangor, Pa, U. S. A.
Gray Foundry Inc., Pou-ltnery, Vt. U. S. A.
Patch Wegner Co., Rutland, Vt. U. S. A.
Friedrich Pensel, Nurnberg, Germany.

APPENDIX III.

Slate Quarries.

Ambler Slate and Stone Co., Ltd., Darhara, Bihar and Orissa.
Kangra Valley Slate Co. Ltd., Lahore.
Messrs. Kashi Ram & Bros., Kund, Distt. Gurgaon.

APPENDIX IV.

Literatur .

A note on the manufacture of school slates in South India by W. Fyfe.	Available from:— Superintendent Government Press, Madras.

APPENDIX V.

Slate Quarries in Bihar and Orissa.

Ambler Slate and Stone Co. Ltd., Bassowine, Dharhara, P. O. Monghyr.

Monghyr Slate Works, Ivy House, Monghyr.

Raj Darbhanga Slate and Stone Works, Dharhara P. O. Monghyr.

Gaya Prasad Singh Sarma, Abhaipur, Piribazar, P. O. Monghyr.

Ashutosh Hui, Chaibassa P. O., Singhbum.

Sewmukh Marwari, „ „

Gopal Chandra Parihari, Serai Kella, P.O., Via Sini, B.N.R.

Bahrun Chamar, Kind P. O., Via Rewari.

Jai Ram Chamar, „ „

Imperial Slate Co., „ „ „

Kangra Valley Slate Co. Ltd., Lahore, Punjab.

Padla Moti Ram, Khol P. O., Gurgaon.

Rewari Slate Co., Rewari, P. O., „

Dass L. Bhavani and Kali, Lower Dharamshala, P. O., Kangra.

F. A. Fitzgereld, Khunyara P. O. Via Dharamsala, Kangra.

Siridhar Narayan Mehta, Sidbari, P. O., Kangra.

Training.

There is no special institution imparting training in the manufacture of stationery goods. This can be had as an apprentice in some factory manufacturing the said articles or it can be arranged through the machinery suppliers for relative trades.

Manufacturers of Stationery goods in India.

Bahay & Co., Lahore.
Croco Stationery Mart, Temple Road, Lahore.
Dhoonimal Dharmdas, Chauri Bazar, Delhi.
Dyalbagh Technical Institute, Agra.
F. N. Gooptu & Co., 12 Beliaghata Road, Calcutta.
K. B. Nath Brothers, Sialkot.
Luxmi Stylo Pen Works, Benares City.
Madras Pencil Factory, Madras.
Tambat Brothers, Lashkar, Gwalior.
T. S. C. Pani & Co., Kumbakonam (W. Kadalangudi).

Journals.

British Stationer, London W. C. 2.
Librero Sud Amencano.
Stationery Trades Journal, London E. C. 4.

APPENDICES

APPENDIX A.

SOME MACHINERY DEALERS IN INDIA.

Alcock W. & Co., Ltd., Hastings St., Calcutta.

Alfred Herbert Ltd., Fort, Bombay and Calcutta.

Asiatic Machinery Co., Ltd., Hornby Road, Bombay.

Balmer Lawrie & Co., Ballard Estate, Bombay and Calcutta.

Bery B. D. & Co., Appollo St., Fort, Bombay, Calcutta, Madras, Delhi and Lahore.

Bharat Engineering Co., Delhi, Amritsar and Cawnpore.

Brady W. H. Co., Ltd., Bombay and Calcutta.

Burn Martin Co., Ltd., Council House Street, Calcutta and Lahore.

Crompton Engineering Ltd., 1st Line Beach, Madras.

Crossley Brothers Ltd., Vanistart Road, Calcutta.

Duncan Stratton & Co., Bank Street, Bombay and Lahore.

Eastern Machinery & Engineering Co., Ltd., Calcutta.

Greaves Cotton & Co., Forbes St., Bombay, Calcutta, Karachi, Lahore and Madras.

Herman B. R. & Mohatta Ltd., Bunder Road, Karachi.

Indo European Machinery Co , Bombay and Lahore.

Jessop & Co., Ltd., Ballard Estate, Bombay, Calcutta, Delhi and Madras.

John Dickinson & Co., Ltd., Fort, Bombay and Calcutta.

John Fleming & Co., Hornby Road, Bombay and Karachi.

John Fowler & Co., Ltd., Bombay and Calcutta.

Kashyap B. & Co., Karachi and Lahore.

Lakshmi Ratan Ltd., Thambu Chetty St., Madras.

Leslie W. & Co., Chowringhee Road, Calcutta.

Linotype and Machinery Co. Ballard Estate, Bombay.

Marshall Sons, Ltd., Ballard Road, Bombay, Calcutta, Madras and Lahore.

Mather & Platt Ltd., Prince Road, Bombay and Calcutta.

Mody P. & Son, Fort, Bombay.

Oakes & Co., Ltd., Mound Road, Madras.

Oriental Machinery Supplying Agency Ltd., Calcutta.

Phatak & Walchand Ltd., Marzagaon, Bombay.

Pinto L. T. & Sons, Lahore.

Popatlal Girdhari Lal & Co., Fort, Bombay.

Roop Chand Engineering Co., Calcutta.

Shanker Das & Co., Rly. Road, Lahore.

Sorabji Shapurji & Co., Ltd., Ballard Estate, Bombay.

Thompson T. E. & Co., Ltd., Calcutta.

Vithal Purshotam & Sons, Appollo St., Bombay.

Worthington Simpson Ltd., Clive Street, Calcutta.

APPENDIX B.

SOME FOREIGN CONSULAR OFFICERS IN INDIA.

Austria.—Consul at Bombay.

Belgium.—Consular General at Calcutta and Bombay. Consuls at Karachi and Rangoon.

China.—Consul General at Calcutta, Consul at Rangoon.

Czechoslovak Republic.—Consuls at Bombay, Calcutta and Karachi.

Denmark.—Consul-General at Calcutta and Consuls at Bombay, Madras, Rangoon, Calcutta, Karachi and Moulmein.

France.—Consul-General at Calcutta ; Consul at Bombay and Consular Agents at Karachi, Madras, Chittagong, Rangoon, Akyab and Jellicherry.

Germany.—Consular-General at Calcutta ; Consuls at Bombay. Rangoon and Calcutta.

Hungary.—Consuls at Madras and Calcutta.

Italy.—Consul-Generals at Calcutta and Bombay.

Japan.—Consul-General at Calcutta and Consuls at Calcutta, Bombay and Rangoon.

Netherlands.—Consul-General at Calcutta, and Consuls at Bombay, Karachi, Madras and Rangoon.

Norway.—Consul-General at Calcutta and Consuls at Bombay, Madras, Rangoon, Akyab, Bassein, Moulmein and Karachi.

Persia.—Consul-General at Delhi and Consuls at Bombay, Madras, Rangoon and Karachi.

Portugal.—Consul-General at Bombay and Consuls at Calcutta, Rangoon, Bombay, and Karachi.

Spain.—Consul at Bombay and Vice- Consuls at Calcutta, Madras, Karachi, and Rangoon.

Sweden.—Consul-General at Calcutta and Consuls at Madras, Bombay, Karachi and Rangoon.

Switzerland.—Consul-General at Bombay and Consuls at Calcutta and Madras.

United States.—Consul-General at Calcutta and Consuls at Bombay, Karachi, Madras and Rangoon.

APPENDIX C.

Sources of Getting Commercial and Industrial Information

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Director of Commercial Intelligence and Statistics, Calcutta.

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H. M.'s Trade Commissioners in India ;

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" 815, Bombay.

and at Columbo (Ceylon).

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The Careers, Moheni Road, Lahore.

APPENDIX D.

PACKING MATERIAL SUPPLIERS.

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Card-Board Box Manufacturing Co., Colootola Street, Calcutta.

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India Card-Board Box Manufacturing Co., Canning Street, Calcutta.

Jubblepore Glass Factory, Jubblepore.

Khanna Box Factory, Cawnpore.

L. B. Verma and Sons, Meston Road, Cawnpore.

Naini Glass Works, Naini, Allahabad.

National Metal Edge Box and Co, 410, 8th Street. Philadelphia. (Paper Box machinery).

N. W. Soap Co., Ltd., Garden Reach Road, Calcutta.

New Castle Cork Supply Co., Sootwood Road, Newcastle upon Tynes England.

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PATENT AGENTS AND HOUSES.

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Acme Trading Co., Pollock Street, Calcutta.

All India Patent House, Civil Lines, Calcutta.

Government of India Patent, Office, Calcutta.

Northern India Chambers of Commerce, Lahore, Delhi, Calcutta, etc.

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Remfry and Sons, Grosvenor House, Old Court House. Street, Calcutta.

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Calcutta Advertising Agency, College Square, Calcutta.

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Ward Lock & Co., Ltd., London.

William Rider & Son, Limited, 8—11 Paternoster Road, London. E. C. 4.

Wm. Dawson & Sons, Common House, London.

For Indian publishers see under Forward Bureau Publications Agents on fly page.

APPENDIX H.

FOREIGN POST—POSTAGE RATES AND FEES

COUNTRIES AND PLACES.

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